SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXV.--No. 8. [NEW SERIES.] NEW YORK, AUGUST 19, 1871. $3 per Annum. [IN ADVANCE.]

FILE CUTTING.

Our artist has, this week, prepared an engraving of one of the most interesting and important handicraft operations, namely, that of file cutting. Before, however, we call special attention to this part of the manufacture of files, it will be best to say something of the forging of files.

In the manufacture of files, the steel must be of good quality and highly converted; for if too soft or unequal in texture, the file itself would soon be worn down instead of the surface upon which it is intended to operate; if, on the contrary, it be too hard, the teeth become brittle and chip off at every stroke.

In forging files coke is preferred as the fuel. The striker is furnished with a large double handed hammer, with a broad face at either end; but the hammer wielded by the maker is smaller and single handed, somewhat conical in shape, the wider end forming the face.

Three-square and half round files are forged in grooved bosses or dies fixed in the anvil. The rod of steel being raised to the proper heat, which ought not to exceed a blood red, the end is hammered until it fills the die; the maker holds the die, and strikes with the small hammer; the striker standing before the anvil deals powerful blows on the heated metal, the flat faces of the hammers covering a considerable portion of the surface of the blank file at each stroke, expanding and leveling it at one operation. When the blank has been forged to the proper length, the tang is also drawn out by cutting into the blank a little on both sides with a chisel, so as to form in many cases sharp square shoulders, and then drawing out the part so cut to form the tang. The maker's mark or monogram is then stamped on. Blanks for round files are formed in a slightly conical swage; blanks for flat and square files are formed by hammering. The maker accustoms himself, as much as possible, to the forging of one description of file, in order that by the concentration of his skill and attention on one article he may attain perfection in its manufacture.

The forged blanks are carefully annealed, or lighted, in order to make the metal soft enough for cutting the teeth. Blanks for common files are softened in an ordinary annealing oven, but the best blanks are protected from the action of the air by being buried in sand contained in an iron box; this is slowly raised to the proper heat, which, as in the forging, ought not to exceed a blood red.

The surfaces of the blanks are next made accurate in form and clean in surface by stripping or grinding. In Sheffield, all the blanks above a certain magnitude are ground on large grindstones. In a few cases, as in dead parallel files, the blanks are planed in the planing machine. The blanks are slightly greased preparatory to being cut.

A few years ago, Dr. Tomlinson, author of the "Cyclopædia of Useful Arts," witnessed the operation of file cutting at the establishment of Messrs. Beardshaw, Stevenson & Co., of Sheffield. His description is so admirable that we cannot do better than to adopt it on the present occasion:

"It is scarcely possible to examine attentively the teeth of a fine file without being struck with their beauty and regularity; but how greatly is our admiration increased when we know that these teeth are cut singly with a hammer and chisel, the workman having no other guide than delicacy of touch and precision of eye, depending however rather upon the former sense than the latter! The cutting room is a long narrow apartment with a range of windows in front, opposite which are placed a number of low stone benches for the anvils, and seats for the workmen. The hammers weigh from one to six pounds each, according to the size of the file; they are curiously formed, the handle being so placed as to allow the mass of metal to be pulled toward the workman while making the blow. The chisels are formed of good tough steel, and also vary with the size of the file; they are somewhat broader than the file to be cut, and are sharpened to the proper angle; they are only just long enough to be held between the fingers and thumb somewhat as a pen is held, only is the left hand, the hollow of the hand being turned to the workman. But the peculiar method of handling the chisel depends in great measure on the kind of tooth to be cut. The file is held to its place on the anvil by means of a leather strap passing over each end of the file, and then under the feet of the workman in the manner of stirrups. At every blow of the hammer the chisel is made to cut a tooth, and the blows follow each other in rapid succession, the workman after every blow advancing the chisel forward by so slight a movement as to be scarcely perceptible. The chisel forms a

FILE CUTTERS AT WORK.

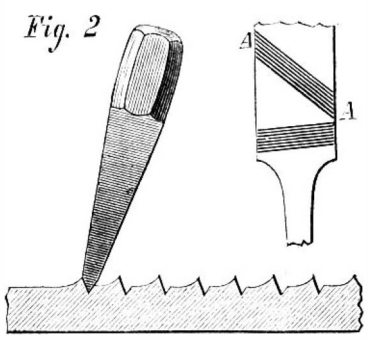


Fig. 2

number of angular grooves parallel to each other, the tooth being formed by the metal left between every two grooves. The skillful workman adjusts the weight of his blow to the kind of metal he is operating upon; and even in the same file, if one part be softer than another, he adapts the weight of his blow so that the teeth may be of the same size in every part. As the work proceeds he gradually shifts the file forward by loosening his tread upon the straps. When one surface is covered with single cuts, he proceeds, in double cut files, to add a second row of teeth, making them cross the first at a certain angle, for which purpose the chisel requires to be held in a particular manner. When one side is covered, he proceeds in like manner to fill a second side; but as the teeth just finished would be injured by placing them on the naked anvil while hammering, they are protected by interposing a flat piece of an alloy of lead and tin, which completely preserves the side already formed. Similar pieces of alloy with angular and rounded grooves are used in cutting triangular and half round files. Rasps, as already noticed are cut with a triangular punch instead of a chisel, every new tooth being placed opposite a vacant space in the adjoining row of teeth.

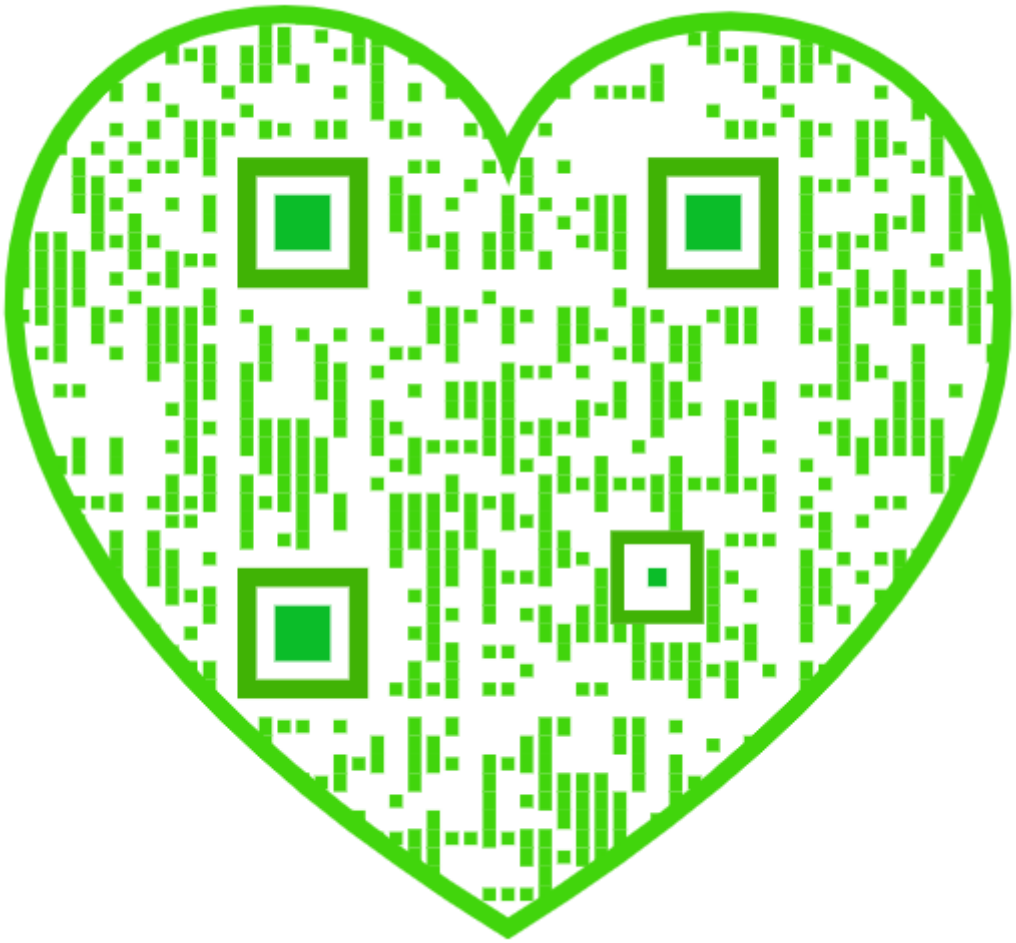
"The curved surfaces of files show in a remarkable way the skill of the file cutter; in them the teeth are formed with straight edged chisels, many rows of short cuts being made from the top to the bottom of the file; and these cuts, uniting together at their extremities, thus form a complete series of lines, passing completely round the cylinder or half cylinder, as the case may be. In fine round files, as many as from ten to twenty rows or cuts are required to cover the surface with teeth; and when it is considered that there may be upwards of a hundred teeth within the space of an inch, some idea may be formed of the many thousand blows required to raise the teeth on a fine file. In double cut files, when one row of teeth is completed, a fine file is run slightly over them, and the surface is greased to moderate the roughness before commencing the second row."

In some of the double cut gullet tooth saw files, as many as twenty-three courses are sometimes used for the convex face, and only two courses for the flat one. The half round and round files are usually cut by apprentice boys, the narrow cuts being less difficult than the broad ones. It might be supposed that all this labor might be saved by using chisels curved to the proper section, instead of straight ones; this plan has been tried, and found to be quite impracticable.

Mr. Holtzapffel describes the operation of cutting in the following terms: "The first cut is made at the point of the file; the chisel is held in the hand at a horizontal angle of about 55° with the central line of the file, as at A, Fig. 2, and with a vertical inclination of about 12° to 14° from the perpendicular, as there represented, supposing the tang of the file to be on the left hand side.

The blow of the hammer upon the chisel causes the latter to indent and slightly to drive forward the steel, thereby throwing up a trifling ridge or burr; the chisel is immediately replaced on the blank and slid from the operator, until it encounters the ridge previously thrown up, which arrests the chisel or prevents it from slipping further back, and thereby determines the succeeding position of the chisel. The heavier the blow, the greater the ridge, and the greater the distance from the preceding cut at which the chisel is arrested. The chisel having been placed in its second position, is again struck with the hammer, which is made to give the blows as nearly as possible of uniform strength; and the process is repeated with considerable rapidity and regularity, sixty to eighty cuts being made in one minute, until the entire length of the file has been cut with inclined, parallel, and equidistant ridges, which are collectively denominated the first course. So far as this one face is concerned, the file, if intended to be single cut, would be then ready for hardening, and when greatly enlarged its section would be somewhat as in Fig. 2. Most files, however, are double cut; that

© 1871 SCIENTIFIC AMERICAN, INC.



is, they have two series or courses of chisel cuts. In cutting the second course, the chisel is inclined vertically as before, at about 12°, but only a few degrees horizontally, or about 5° to 10° from the rectangle, as shown in Fig. 2. "The blows are now given a little less strongly, so as barely to penetrate to the bottom of the first cuts, and from the blows being lighter they throw up smaller burrs, consequently the second course of cuts is somewhat finer than the first. The two series, or courses, fill the surface of the file with teeth, which are inclined towards the point of the file, and when highly magnified, much resemble in character the points of cutting tools generally; for the burrs which are thrown up and constitute the tops of the teeth are slightly inclined above the general outline of the file, minute parts of the original surface of which still remain nearly in their first positions. Taper files require the teeth to be somewhat finer towards the point, to avoid the risk of the blank being weakened or broken in the act of its being cut, which might occur if as much force were used in cutting the teeth at the point of the file, as in those at its central and stronger part."

The files are next hardened before they are fit for use. Some descriptions, however, such as are used upon wood, ivory, and other soft substances, are not hardened; such files admit of being sharpened up with a hand file. Some of the curved files used by sculptors and die sinkers are made of iron and case hardened.

Alvan Clark and his Telescopes.

Just at the end of the Brookline bridge, in Cambridge, Mass., stands a modest looking brick building that most persons would not consider worthy of a second glance, if indeed it attracted their attention; and near this building is another surmounted by a dome. These form the establishment of Alvin Clark, who has a world-wide reputation as a builder of telescopes, and also as an amateur astronomer.

Mr Clark was originally a miniature painter, and quite a successful one, as many paintings still in his possession prove. Some years ago his attention was accidently called to the subject of telescope making, from a description given by one of his sons of the small telescope at Amherst college. After hearing this, Mr. Clark remarked that he could make a telescope, and accordingly went to work and made one. His first instrument proved so successful that he was encouraged to persevere. One of his friends remarked to him about this time, "Mr. Clark, if you wish to know how to make telescopes, you will have to go to the place where they are made." But Mr. Clark thought some things might as well be studied out as learned from another, and so persevered, and was soon enabled to retaliate upon his friend by telling him that he had learned how to make telescopes, independent of instructors.

His telescopes are the kind known as refracting. In these the principal parts are the field or object glasses, or objectives, as they are most frequently called, and the eye piece. The principal use of the objectives is to collect the rays of light coming from the object, and to form an image at the focus of the lens. This image is afterwards magnified by the eye piece.

On the perfection of this focal image depend to a great extent the power and capabilities of the instrument. It must be colorless, or at least have no fringes on the edges; it must also be sharp and well defined, and have a large amount of light thrown on it. The first two of these conditions may be filled with a glass of a comparatively small diameter, but in order to accomplish the third, the diameter must be increased to as great an extent as possible.

Mr. Clark's first telescopes were distinguished for their freedom from chromatic and spherical aberration, as the first two errors are called, and latterly he has been devoting his time more especially to increasing the size of the glasses.

In order to correct the chromatic aberration, the objective is made of two disks of glass. The first of these, or the convex lens, is made of crown glass. This alone would form an image at the focus, but the image would be fringed with the colors of the spectrum. In order to prevent this, a concavo-convex lens, made of flint glass, is placed directly behind the first glass; this recomposes the white light which the first lens has decomposed, and forms an image at the focus that is almost perfectly colorless. In order to make it perfectly colorless, we should have to use more than two lenses.

There still remains the spherical aberration to be corrected. This is owing to several causes. In the first place, it may be that the glass is a little more dense on one side than on the other; this will serve to distort the image somewhat, and must be corrected by proper grinding. Then a portion of the glass may polarize light while another portion does not; this must also be corrected by grinding.

In order to test the glasses for these errors, they are placed on a carriage and run into a long tunnel which has a small spot of light at the further end. If now the eye be placed at the focus of the lens, a sharp clear image of the spot will be seen, provided the lens is perfect; otherwise it will be distorted and colored. It must also, when examined with a Nicol's prism, still remain free from color. If this is not the case, the glass is removed, repolished, and the test is repeated.

In order to grind the glasses, a coarse emery is first used, until they have been brought very nearly to the perfect form required. Then finer grades of emery are applied, and finally they are polished with rouge. The process takes a long time from the first arrival of the rough glass, until it becomes the finished objective. Almost the whole of the grinding is done by hand, on laps made of cast iron. These are used at first naked, and afterwards covered with pitch.

Telescopes are generally spoken of as being of so many inches aperture; and until within a very few years a telescope of fifteen inches aperture was regarded as enormous. In 1867, Mr. Clark constructed one of twenty inches aperture, for the observatory at Chicago. This at the time was the largest refracting telescope ever made. Since then one of twenty-four inches aperture has been made in England; and now the Messrs. Clark have orders for two of twenty-five inches aperture; one intended for the Government observatory at Washington, the other to go to Virginia.

These telescopes will be about twenty-five feet long when finished, the rule being that a telescope should be as many feet long as the objective is inches in diameter. Any one who wishes to indulge himself with one of these instruments as a toy, can do so at an expense of about $100,000, and there will most likely be a further expense of $50,000 in providing a place to keep it. These large telescopes are so nicely adjusted that a person can easily move them with a finger, although they weigh several tuns. Besides making telescopes, Mr. Clark has made a specialty of spectroscopes. He has constructed some very fine ones; among others that of Professor Young, to which we have alluded in the *Journal*. This instrument has been almost completely rebuilt, and some improvements suggested by experience have been added. Mr. Clark has also built a new telescope for Professor Young, of nine and one third inches aperture. This instrument has a steel tube, made of plates of steel riveted together, as it has been found that steel tubes can be constructed so as to weigh less and yet be stiffer than wooden ones.—*Boston Journal of Chemistry.*

Iron Telegraph Poles---An Invention Wanted.

Experience has shown that over large tracts of the Western territories, telegraph lines are daily exposed, at certain seasons of the year, to destruction from lightning. Certain circuits are, from this cause, interrupted to such an extent that they cannot be relied upon. A dozen or a hundred poles are shattered at a stroke, and a day is lost before connection can be restored. When telegraphic connection is first established and given to a people, irregularity is endurable, and patiently borne. But when attainable means of securing permanent intercourse with "the rest of mankind" begin to exhibit themselves, patience, having had her "perfect work," very properly demands release. So we have before us a cry from the Western plains for help, and in a direction where the means of supply seem abundant. The State of Missouri says to us, "my mountains are full of iron; your telegraph lines are shivered daily by bolts of lightning; I am exposed to isolation from my Pacific sisters; mold my iron into poles and plant them along the roads where the lightning reigns, and make a highway which shall be forever."

Now if this be the solution, there is wanted a design for an iron structure, and estimates of its cost. Many years ago we obtained such estimates, and published an article illustrated by a sketch of an iron telegraph pole, on which, curiously enough, was engraved the words "Pacific Telegraph." This was in 1853. That design embraced—

1. A foundation of stone, a single block five feet long and a foot square, planted firmly in the earth.

2. A neatly molded iron pole twelve feet high, terminating in a receptacle into which could be placed a wooden frame for the insertion of the insulators, and which could be removed for cleansing or repair at pleasure. This iron pole to be planted on the stone basis.

At that time such a line could have been provided at comparatively low rates, and the idea took possession of us as a future work when telegraph contractors being all well buried and happy, the pole had to be as permanent as the rail. That time seems to be coming. We invite attention to it. The foundation need not be stone. The top need not be wood, although we would suppose it best. Let us see whether in some simple style, in which taste and utility may blend, an iron highway can be provided over our Western territories to render communication at all times perfect and reliable.

We notice that Superintendent Tubbs has adopted the Varley plan of running a wire from the top of the poles on his exposed lines to the earth, to save them from destruction by lightning, with successful results.—*Journal of the Telegraph.*

Dish Washing Machine.

The object of this invention is to provide convenient means for cleansing dishes by machinery, thus saving much time and labor. A box is elevated so as to be of convenient height, preferably with a circular or inclined bottom, to conduct the water to one point; but this is not an indispensable feature, as the machine will work with a flat or level bottom. A washing wheel revolves transversely in the vessel, formed of a shaft and arms more or less in number, to which are attached wings. This washing wheel is revolved by means of a crank, on one end of the wheel shaft, and is placed so that the wings will sweep a short distance from the bottom. Removable racks, which fit into the box on either side of the washing wheel are provided with vertical slides for separating the plates or dishes which are placed in the machine. Above the racks and the washing wheel are removable trays, one or more, with lattice bottoms, and with slides constructed and arranged so as to admit and support any kind of dishes which it may be desired to put into the machine.

The inventor does not confine herself to any particular construction or arrangement of the racks or trays; but constructs them in such a manner that the space each side and above the wheel shall be utilized and the whole made convenient for placing in the machine and removing therefrom ordinary table dishes, and so that when placed in the machine they shall be exposed separately to the action of the water or suds employed in the washing process.

When sufficient quantity of hot water and soap has been placed in the machine and has been fastened down, the wheel is turned six or eight revolutions in either or both directions, when the water is drawn off through the orifice, and clean hot water is introduced and the wheel is again revolved. This completes the washing. The water is drawn off and the cover is raised, which allows the steam or vapor to escape. This soon dries the dishes and they are again ready for use. Harriet C. Robertson, of East Saginaw, Mich., is the inventor of this machine.

Combined Rubber and Copper Wire for Pipe Couplings.

Mr. FREDERICK KIBLER, of Baltimore, Maryland, has patented an improved joint for water pipes, steam pipes and steam chests, around bolts and other places, whether the joint be round, square, or of any other shape, which is claimed to be simple in construction and reliable and effective in use; it consists in a rubber or equivalent plate and copper wire for forming the joint. The plate made of rubber or other suitable material, is cut to fit between the faces that form the joint. Upon the plate is placed a copper wire, bent into a form corresponding with the hole or opening around which the joint is formed. The copper wire, which forms the real joint, should be one size larger than the thickness of the rubber plate, so that it may be flattened down between the faces of the joint, and may thus make the joint more perfect. This construction enables the wire to be arranged upon the rubber plate as may be desired, or so as to avoid flaws or imperfections in the plates or faces between which the joint is formed. If desired, two rubber plates may be used, with the copper wire placed between them.

Use of Silicate of Potassa in Strengthening Fossil Skeletons.

A very judicious application of the silicate of potassa has been lately made at the Museum of Natural History of Paris, in repairing a great many fossil skeletons which had been disseverated and broken by the shells bursting in this palace of science.

The solutions have been first used diluted to about 30° Beaumé, and afterwards of a higher degree of concentration. The adherence of the broken or separated pieces is brought together by applying with a brush some of the solution of silicate of potassa on the parts to be joined, then they are left to dry, and the joint is hardly visible; and the joined part is far stronger than the remainder of the bone. Very delicate and porous anatomical pieces, as skeletons of birds, insects, etc., can be dipped repeatedly in more diluted solutions, and thus be rendered very hard and tenacious.

The Manufacture of Albumen.

The enormous consumption of albumen, both for photographic purposes and the printing of textile fabrics with aniline colors, has led many chemists to search for means of producing it, other than by using the whites of eggs. As far as we know, all attempts to produce it synthetically have been failures. On page 89, Vol. XXII., we described the process of obtaining it from blood and from fish roes; and the latter source of supply has now been rendered more largely available by a new mode of treatment, devised by Herr Grüne, of Frankfort-on-Maine. The roes are rubbed, through a sieve, with a hard brush, leaving the cellular tissues behind. The liquid albumen runs through the sieve, and is left to settle in tall, upright vessels, after which it is poured into shallow pans and evaporated in drying chambers. Before evaporation, it should be filtered through sand. Albumen from the roes of fresh-water fish is fine and clear, and fit for immediate use; but that from sea fish will have an unpleasant odor, if the process be not done when the roes are quite fresh.

Gripers for Printing Presses.

Ordinary presses now in use are provided with gripers of a certain size and style. The same will answer for all ordinary purposes; but where one cylinder is used on a double-feeder press, as, for example, the oscillating cylinder on the well-known "Wharfedale," and registers two sets of gripers for holding the sheets alternately at opposite ends, such gripers are only useful for certain defined sizes of sheets, unless they are made adjustable. To thus make them adjustable is the object and result of an invention made by Thomas J. Plunket of New York, and assigned by him to Victor E. Mauger, also of New York.

The printing cylinder is provided with two sets of gripers, which are secured to vibrating rods and controlled in their motions, by cams or other suitable mechanism. The ordinary gripers are made to extend a suitable distance from the rods, to hold sheets of a suitable size. The improved gripers fit through perforated sleeves mounted upon the rods, or through apertures in said rods, and can be adjusted to suit the several sizes of papers to be held between them, and clamped by set screws or other means. Instead of being adjustable on the rods, the gripers may made in sections, so that the outer may be moved on the inner.

Improved Can for Nitro-Glycerin.

JACOB TAYLOR, of Petroleum Center, Pennsylvania, has patented an improved can for nitro-glycerin, wherein, it is claimed, nitro-glycerin and other explosive compound or material may be safely transported, and whence it can be conveniently removed for use. The invention consists on suspending the can by elastic bands or springs within an inclosing case or shell, the spring being so regulated that the can will always be kept clear of the shell during the oscillations and movements of handling and conveying. The contact of the can with any hard substance is thus avoided, and explosions from such causes consequently prevented.

The reduction of the public debt during the month of July was $8,701,976.

© 1871 SCIENTIFIC AMERICAN, INC.

On the Gaseous and Liquid States of Matter.

A discourse was recently delivered at the Royal Institution, London, by Dr. Andrews, on the "Gaseous and Liquid States of Matter," from which we take the following:

The liquid state of matter forms a link between the solid and gaseous states. This link is, however, often suppressed, and the solid passes directly into the gaseous or vaporous form. In the intense cold of an arctic winter, hard ice will gradually change into transparent vapor without previously assuming the form of water. Carbonic acid snow passes rapidly into gas when exposed to the air, and can with difficulty be liquified in open tubes. Its boiling point, as Faraday has shown, presents the apparent anomaly of being lower in the thermometric scale than its melting point, a statement less paradoxical than it may at first appear, if we remember that water can exist as vapor at temperatures far lower than those at which it can exist as liquid. Whether the transition be directly from solid to gaseous, or from solid to liquid and from liquid to gaseous, a marked change of physical properties occurs at each step or break, and heat is absorbed, as was proved long ago by Black, without producing elevation of temperature. Many solids and liquids will for this reason maintain a low temperature, even when surrounded by a white hot atmosphere, and the remarkable experiment of solidifying water and even mercury on a red hot plate, finds thus an easy explanation. The term spheroidal state, when applied to water floating on a cushion of vapor over a red hot plate, is, however, apt to mislead. The water is not here in any peculiar state. It is simply water evaporating rapidly at a few degrees below its boiling point, and all its properties, even those of capillarity, are the properties of ordinary water at 96°·5 C. The interesting phenomena exhibited under these conditions are due to other causes, and not to any new or peculiar state of the liquid itself. The fine researches of Dalton upon vapors, and the memorable discovery by Faraday of the liquefaction of gases by pressure alone, finished the work which Black had begun. Our knowledge of the conditions under which matter passes abruptly from the gaseous to the liquid and from the liquid to the solid state may now be regarded as almost complete.

In 1822 Cagniard de la Tour made some remarkable experiments, which still bear his name, and which may be regarded as the starting point of the investigations which form the chief subject of this address. Cagniard de la Tour's first experiments were made in a small Papin's digester constructed from the thick end of a gun barrel, into which he introduced a little alcohol and also a small quartz ball, and firmly closed the whole. On heating the gun barrel with its contents over an open fire, and observing from time to time the sound produced by the ball when the apparatus was shaken, he inferred that after a certain temperature was attained the liquid had disappeared. He afterwards succeeded in repeating the experiment in glass tubes, and arrived at the following results. An hermetically sealed glass tube, containing sufficient alcohol to occupy two fifths of its capacity, was gradually heated, when the liquid was seen to dilate, and its mobility at the same time to become gradually greater. After attaining to nearly twice its original volume, the liquid completely disappeared, and was converted into a vapor so transparent that the tube appeared to be quite empty. On allowing the tube to cool, a very thick cloud was formed, after which the liquid reappeared in its former state.

"It is singular that in this otherwise accurate description Cagniard de la Tour should have overlooked the most remarkable phenomenon of all—the moving or flickering striæ which fill the tube, when, after heating it above the *critical point*, the temperature is quickly lowered. This phenomenon was first observed by the lecturer in 1863, when experimenting with carbonic acid, and may be admirably seen by heating such liquids as ether or sulphurous acid in hermetically sealed tubes, of which when cold they occupy about one third of the capacity. The appearances exhibited by the ascending and descending sheets of matter of unequal density are most remarkable, but it is difficult to give an adequate description of them in words or even to delineate them.

"These striæ arise from the great changes of density which slight variations of temperature or pressure produce when liquids are heated in a confined space above the critical point already referred to; but they are not formed if the temperature and pressure are kept steady. When seen they are always a proof that the matter in the tube is homogeneous, and that we have not liquid and gas in the presence of one another. They are, in short, an extraordinary development of the movements observed in ordinary liquids and gases when heated from below. The fact that, at a temperature 0°·2 above its critical point, carbonic acid diminishes to one-half its volume from an increase of only $\frac{1}{3^1_7}$ of the entire pressure, is sufficient to account for the marked characters they exhibit.

"If the temperature be allowed to fall a little below the critical point, the formation of cloud shows that we have now heterogeneous matter in the tube, minute drops of liquid in presence of a gas. From the midst of this cloud, a faint surface of demarcation appears, constituting the boundary between liquid and gas, but at first wholly devoid of curvature. We must, however, take care not to suppose that a cloud necessarily precedes the formation of true liquid. If the pressure be sufficiently great, no cloud of any kind will form.

A VERY cheap varnish must, of necessity, be dear at any price, for it is certainly more profitable to give the customer a varnish that will wear well, and save one's self the trouble and expense of repainting, thus doing two jobs for the price that should be received for but one.

Vinous Fermentation.

The following remarks are extracted from Dussauce's treatise on the "Manufacture of Vinegar," noticed in our last issue:

Vinous fermentation has been, from the earliest times, intrusted to inexperienced hands; it was only towards the end of the eighteenth century that chemistry began to explain it, and it is to the works of Fabroni, Legentil, Chaptal, Dandolo, etc., that it owes primarily the improvements it has received. In the act of alcoholic fermentation, all the ferment is not decomposed; indeed, it requires only 1½ part of dry ferment to transform 100 parts of sugar into alcohol. The carbonic acid gas, which is disengaged, carries with it some aqueous alcohol which marks 14°.

Lavoisier proved, by a direct experiment, that alcohol was due to the decomposition of sugar by a ferment. He took:—

Sugar	50.000 kilog.
Water	200.000 "
Yeast in paste	3.620 "
Dry yeast	1.375 "

When the fermentation was established, the new products were:—

Water	200.200 kilog.
Alcohol	28.250 "
Carbonic acid	17.300 "
Acetic acid	1.225 "
Undecomposed sugar	2.003 "
Dry yeast	0.674 "

If all the sugar had been decomposed, there would have been about 30 kilogrammes of alcohol.

M. Gay Lussac has obtained from 50 kilogrammes of sugar:—

Alcohol	51.34
Carbonic acid	48.66
	100.00

Lavoisier thought that, in the vinous fermentation, a portion of the sugar was oxygenized at the expense of the other; and that one, more hydrogenated, formed alcohol, while the other was converted into carbonic acid, which was explained as follows: Sugar, like organic substances in general, is composed of carbon, hydrogen, and oxygen; in its decomposition, oxygen forms, with a part of the carbon, carbonic acid, and hydrogen, with the remaining carbon, produces alcohol.

M. Gay-Lussac, in his theory (*Ann. de Chimie*, vol. XCV.), supposes that sugar is composed of 40 parts of carbon, and 60 of water or its elements; if those weights are changed in volumes of each of the constitutive principles of this body, we obtain:—

Vapor of carbon	3 vols.
Hydrogen	3 "
Oxygen	3½ "

And we know that analysis has demonstrated that alcohol is composed of:—

1 vol. of bicarburetted hydrogen.	Vapor of carbon	2 vols.
	Hydrogen	2 "
1 vol. of vapor of water	Hydrogen	1 vol.
	Oxygen	½ "

From these elements of composition, omitting the weak products of the ferment, to consider only the alcohol and the carbonic acid, we find, by examining the composition of the sugar and that of the alcohol, that to produce that liquor, we must take from the sugar one volume of vapor of carbon and one volume of oxygen, which, by combining, produce one volume of carbonic acid gas, while the combination of the hydrogen and the other parts of the constituents of the sugar produce alcohol. According to this theory, if we reduce the volumes to weight, 100 parts of sugar, decomposed by the fermentation, are changed:

Into alcohol	51.34
" carbonic acid	48.66

Whatever probability there may be in this theory, it yet remains to determine what becomes of the nitrogen of the ferment, which is not mixed with the carbonic acid, nor is it a constituent principle of the white substance which is precipitated and is due to the decomposition of the ferment, nor of the small quantity of that very soluble substance which is found in the alcoholic product; however, it is certain that the carbonic acid and alcohol are both formed at the expense of the sugar.

This is a great question to solve. Is air necessary to the fermentation? In the affirmative we find a great chemist, whose name is the greatest authority. Gay-Lussac squeezed into a tube full of mercury, and well deprived of air, some grains of grapes; the fermentation would not begin until a little oxygen had been passed into it. M. de Fontenelle announced that, having filled with oil five bottles of 15 litres each, so as to remove the air adhering to the sides, he emptied them and immediately filled them with grape juice, covering this with a layer of oil about six inches thick, and that, notwithstanding the total privation of air, the fermentation began two days after; which would seem to prove that the pressure of the air is not an absolute necessity. In the above experiment, we believe the fermentation took place on account of the air contained in the juice. According to the calculations and the theory of M. Gay-Lussac, none of the elements of the air enter in the formation of the carbonic acid and alcohol, which are entirely due to the sugar. Moreover, he has himself ascertained that sugar and barley fermented very well without the contact of air (*Ann. de Chimie*, vol. LXXVI.); it is, therefore, easy to conclude that the quantity of alcohol ought to be in direct ratio with that of the saccharine matter.

Like grape juice, the different saccharine vegetable substances are susceptible of undergoing the vinous fermentation with or without the addition of ferment, provided they contain the nitrogenous substances necessary to perform the functions of a ferment. Thus, apple juice gives cider, that of pear, perry; and the saccharine matter developed in fermented and roasted barley, beer; honey and molasses, diluted with a sufficient quantity of ferment, result in a more or less strong alcoholic liquid.

Propulsion by Steam on Canals.

Among the large pile of letters on this subject with which our readers have favored us, is one from Mr. C. W. Hermanee, of Schuylerville, N. Y., who gives his adherence to the ordinary screw propeller as the only suitable motor, not only on the ground of the large proportion of work done to power required, but also on account of the small and easily governed swell caused by that means of propulsion. He goes on to say that the modification of the box shaped boat, which is the form of all others adapted for the destruction of the canal banks, need not reduce the carrying capacity, nor necessitate the expense of reconstructing the boat. He suggests a false or adjustable bow, so formed as to make the displacement gradual, and which can be removed from the boat when it is passing through locks. He proposes to attach this bow to the vessel by a hinge so that the bow can be hauled up out of the water whenever necessity arises. The ease with which the bow can be elevated, and the obvious adaptability to boats now in use, are considered by Mr. Hermanee as points in favor of his device. He claims, moreover, that one team of horses can tow a box shaped boat with his attachment faster than two teams can without it.

Mr. Hermanee supplements this improvement of the boat's bow by boxing the screw to limit its lateral wash, and by making an opening, in the bottom of the boat, inclining upwards towards the screw; and states "that the direction given to the water, being forced up through the inclined space, has a tendency to carry it to the surface without injury to the canal structure." He invites criticism of and comments on his plan.

Another correspondent, Mr. A. S. Ellis, of Springfield, Ohio, suggests an iron tug, so constructed as to be attachable by means of ropes, to the bow of the boat; so that the tug will form a bow to the vessel, and must be large enough to contain the engine and the screw propeller. The canal locks would need enlargement, if the tug were not detached in passing through them, which latter could easily be done. By making a close connection between the tug and the boat, the rudder of the boat would be enabled to steer the compound vessel.

How Crude Rubber is Collected.

Greytown, Nicaragua, is the principal port for the export of india rubber on the coast. It is collected by parties of Indians, Caribs, or half cast Creoles, seldom by Europeans, to whom the dealers, who are also storekeepers, advance the necessary outfit of food, clothing, and apparatus for collecting rubber, on condition of receiving the whole of the rubber collected at a certain rate. The rubber hunters are termed *Uleros* (*Ule* being the Creole term for rubber). A party of Uleros, after a final debauch at Greytown, having expended all their remaining cash, generally make a start in a canoe for one of the rivers or streams which abound on the coast, and having fixed on a convenient spot for a camp, commence operations. The experienced rubber hunter marks out all the trees in the neighborhood. The rubber tree is the *Castilloa elastica*, which grows to a great size, being on an average about four feet in diameter, and from twenty to thirty feet to the first spring of the branches. From all the trees in the almost impenetrable jungle hang numerous trailing parasites, lianes, etc., from these, and especially the tough vines, are made rude ladders, which are suspended close to the trunks of the trees selected, which are now slashed by machetes in diagonal cuts from right to left, so as to meet in the middle and central channels, which lead into iron gutters driven in below and these again into the wooden pails. The pails are soon full of the white milk, and are emptied into larger tin pans. The milk is next pressed through a sieve, and subsequently coagulated by a judicious application of the juice of a Bejuca (an *Apocyna*?) vine. The coagulated mass is then pressed by hand, and finally rolled out on a board with a wooden roller. The rubber has now assumed the form of a large pancake, nearly two feet in diameter and about a quater of an inch thick, on account of which they are termed *tortillas* by the Uleros; these cakes are hung over the side poles and framework which supports the *rancho*, which is erected in the woods, and allowed to dry for about a fortnight, when they are ready to be packed for delivery to the dealer.

Why Circles Please the Eye.

Professor Müller, in a course of lectures in Berlin, offered a simple and mechanical explanation of the universal admiration bestowed on these curves. The eye is moved in its socket by six muscles, of which four are respectively employed to raise, depress, turn to the right, and to the left. The other two have an action contrary to one another, and roll the eye on its axis, or from the outside downward, and inside upward. When an object is presented for inspection, the first act is that of circumvision, or going round the boundary lines, so as to bring consecutively every individual portion of the circumference upon the most delicate and sensitive portion of the retina. Now, if figures bounded by straight lines be presented for inspection, it is obvious that but two or three muscles can be called into action; and it is equally evident that in curves of a circle or ellipse all must alternately be brought into action. The effect then is, that if two only be employed, as in rectilinear figures, those two have an undue share of labor; and by repeating the experiment frequently, as we do in childhood, the notion of tedium is instilled, and we form gradually a distaste for straight lines, and are led to prefer those curves which supply a more general and equable share of work.

© 1871 SCIENTIFIC AMERICAN, INC.

HYDRAULIC BUFFER FOR CHECKING THE RECOIL OF HEAVY GUNS.

The ingenious instrument, the name, of which stands at the head of this paper, deserves some notice not only account of its utility for its purpose, but as an interesting method of meeting and overcoming those violent efforts of Nature to which she is provoked by explosion. In the recoil of a heavy gun, we have an example of the greatest force which man attempts to control. The inventions of Captain Moncrieff, which not long ago formed the subject of an article, seek to utilise this force; other gun carriages led it to expend itself as harmlessly as possible.

The hydraulic buffer accomplishes this latter object in a manner very ingenious, and affording some interesting illustrations of Nature's laws; it also possesses several advantages over other methods which have been and are still used. For it the public service is indebted to Colonel Clerk, R.A., F.R.S. Superintendent of the Royal Carriage Department in Woolwich Arsenal. Before the introduction of the hydraulic buffer into the English service, and in those cases where it is not yet applied, the method employed to overcome the recoil was the friction of iron plates. To the bottom of the gun carriage several plates are fixed, which pass between long plates placed along the middle of the slide or platform of which the carriage runs; and the friction of their surfaces in contact overcomes the force of the recoil, and brings the gun and carriage to a standstill. The amount of the friction can be regulated by the compression given to these plates, and requires to be altered for the various charges used. The compression must be taken off to allow the gun to be run forward to the fitting position, and must be again set up to meet the recoil. The hydraulic buffer, on the other hand, is always ready for use, and never needs any adjustment. This is one of its advantages, and one which is of special importance in the heat and excitement of action. It consists of a cylinder (A B in figure) placed in the platform, and lying along its length. In the cylinder is a piston pierced with four holes, and the extremity of the piston rod is attached to the carriage. When the gun and carriage are run out for firing, the piston is moved to the lower end of the cylinder (A) which is filled with water, except a small air space exceeding slightly the cubic content of the piston rod, so as to allow for the displacement of the water when the piston is driven to the other end of the cylinder.

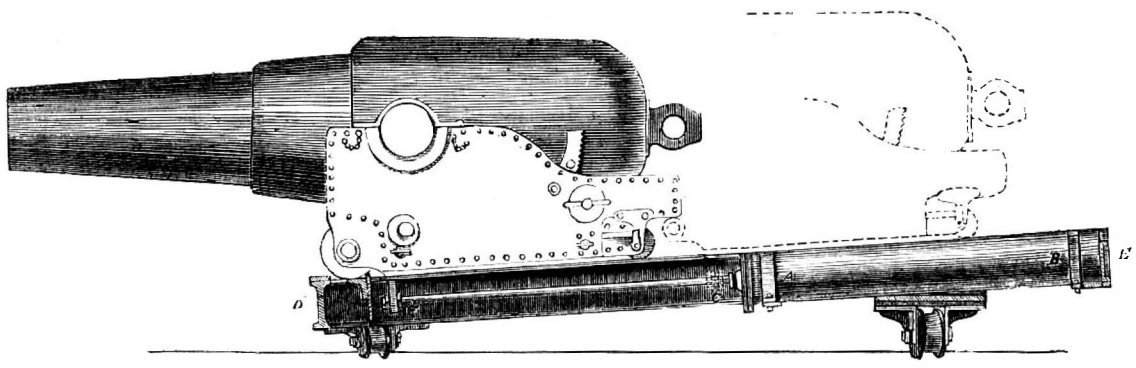
When the gun is fired, and with its carriage begins to recoil, the piston is driven back into the cylinder. The first effect of this is to compress the air in the cylinder very violently; then the water begins to run through the four holes in the piston; this motion soon attains a very great velocity; and in imparting this to the water, the force of the recoil is soon exhausted. It is spent in transferring the water with great rapidity through these orifices from one side of the piston to the other.

This rapidity depends on the ratio of the area of the piston to the area of the four holes in it. A very small diminution in the area of these orifices would cause the recoil to be checked very much sooner; a correspondingly slight increase would allow the piston to strike with violence against the end of the cylinder. It was found in an experiment with a twenty pounder gun, that when the holes were 0·562 of an inch in diameter, the recoil extended the whole length of the cylinder, 2 feet 9 inches, and struck violently the end of it; when a piston was used with holes 0·437 inches in diameter, the recoil was only 1 foot 11 inches, and ended quietly, the same charge being used. In another experiment with a twelve pounder gun in a boat carriage, the holes in the piston being five eighths of an inch in diameter, the recoil was 2 feet 2 inches; when the diameter of the holes was increased by one sixteenth of an inch, the recoil was 3 feet 2 inches. The reason of this is evident from a little consideration; first, every addition to the area of the holes diminishes the area of the piston. which acts on the water; secondly, the difference of the work done by the recoil is proportional to the difference of the *squares of the velocities* given to the water in passing through the orifices in the two cases.

The proper ratio of the area of the holes to the area of the piston is evidently that which will allow the recoil to expend its force in nearly, but not quite the whole length of the cylinder. When once this ratio is fixed, it is very remarkable that the amount of the charge, or the slope at which the platform is placed, whether up or down or horizontal, makes comparatively little difference in the length of the recoil. With a 12 tun (300 pounder) gun, a service charge of 30 lbs. of powder gave a recoil of 4 feet 5 inches; with a battering charge of 43 lbs. the recoil increased only to 5 feet 1 inch. If the charge be heavy, or if the slope favors the recoil, the carriage will not go much further back than if these conditions are reversed. But it will do so more rapidly. The space travelled over is not much greater with the violent recoil, but it is done in a shorter time. It is also worthy of notice that quick burning powder, such as the rifled large grain, does not give so long a recoil as the slow burning ones, such as the pebble and pellet powders, although it acts much more violently on the gun; the reason is that the recoil is more rapid. Few machines give so striking an illustration of how important an element is time in work to be done, and how much force is to be increased if anything is done more rapidly. The strength of one man is quite sufficient to push in or pull forward the piston of the hydraulic buffer, because he does it quietly, "takes his time to do it." The force of a 25 tun gun, recoiling from the discharge of 70 lbs. of powder, and a 600 lb. shot exhausted itself in doing the same, because it does it so quickly.

In fact, the ease with which the hydraulic buffer permits slow motion is one of its disadvantages, and prevents its application to sea service carriages, as it would not keep the carriages from moving as the ship rolled. A modification to obviate this difficulty has been proposed. It consists of a solid piston (without holes), and the back and front ends of the cylinder are connected by a pipe through which the water is driven by the recoil. The motion of the water can be stopped altogether by the stop cock till the gun is fired, and the area of the orifice through which the water is to pass can also be regulated by it.

The resistance of the water, and consequently the pressure on the cylinder from the recoil, is not uniform. It becomes greatest at the moment when the air receives its maximum compression, before the water attains its highest velocity in passing through the holes in the piston. At this point the force of the recoil is felt as a severe strain upon the cylinder and the platform which holds it. This destructive action of



HYDRAULIC BUFFER FOR CHECKING THE RECOIL OF HEAVY GUNS.

the recoil of heavy guns not only upon platforms, pivots, and racers, but also upon the foundations on which they rest, is one of the great difficulties with which modern military engineering has to grapple. To remedy this disadvantage by causing the recoil to meet with a gradually increasing resistance, so that its force may be felt as a continuous pressure, and not at any point as a shock or blow, the following very ingenious arrangement was proposed by Mr. H. Butter, Chief Constructor in the Royal Carriage Department. It consists in placing, along the length of the cylinder and through the holes in the piston, four tapering rods, the largest extremities of them being at the rear end of the cylinder, and being of such a size as there to fill completely the piston holes. These orifices and also the whole cylinder must be larger than when the rods are not employed. The effect in this case is that, as the area for the water to flow through the piston is continually diminishing as the holes get further along the rods, the force of the recoil has to impart a continually increasing velocity to the water, and is at no point felt as a shock or blow. The resistance, slight at first, gradually increases throughout the recoil, and so exhausts its force not at any one point, but throughout the whole of its course.

It has been suggested, and it is a consummation most devoutly to be wished, that the hydraulic buffer might be applied to railway trains so as to take away the destructive effects of a collision. A train of carriages separated by hydraulic buffers would, if suddenly stopped at a high speed, simply close up, the piston being driven in, and the force of the collision would exhaust itself in the motion given to the water in the cylinders. Some practical difficulties stand in the use of this application of the invention; principally, that the length of the piston rods would inconveniently increase the length of the train. But there are none which might not be overcome by a little ingenuity; and the great importance of the object to be gained makes the neglect of any promising means to attain it highly culpable. However, slowness in taking up new ideas (especially if they do not immediately add to dividends,) is not altogether a peculiarity of Government departments.

A very interesting pamphlet on this subject has been published by Colonel Clerk, in which Mr. Butter shows the work done in the hydraulic buffer, by comparing it with the momentum of a similar weight of water falling through such a hight as to give it the same velocity as that with which it passes through the holes in the piston. By this ingenious comparison he ascertained that a locomotive engine, weighing 50 tons, and moving at the rate of 30 miles an hour would be brought to rest in the space of six feet by two hydraulic buffers of 12 inches diameter. "There are," Colonel Clerk remarks, "two important problems to be worked out by the railway authorities;—(1) to have no railway collisions; (2) if they must sometimes occur, to render them as harmless as possible;" and it is with the second that he deals. The plan which has been so successful in meeting the violence of exploding gunpowder, should at least, have a trial in a case of far greater importance—security to life in railway collisions. To refuse this, on account of a few difficulties or inconveniences, seems a sin against Nature herself.

A Great Railroad Feat.

On Sunday morning, July 23d, between daylight and eleven o'clock, says the *National Car Builder*, the gage of the Ohio and Mississippi Railroad track, for a distance of 340 miles, was changed from six feet to four feet nine inches. This is, without exception, the greatest feat of the kind ever attempted. Every preparation was of course made in advance to facilitate the operation, and its accomplishment was so successful that the regular trains were expected to run by schedule time on the new gage by the following Tuesday. The force of laborers was distributed in gangs of eight men to each mile of road, and there was no cessation of the work from its commencement until it was completed. Twenty-eight locomotives and fifty passenger cars, including baggage, mail, express, parlor, and sleeping cars, have been reduced to the narrow gage, leaving seven hundred cars, of all classes, and fifty-four locomotives yet to be changed to the new gage. The difference between the old and new gage being fifteen inches, both lines of rails had to be moved instead of one only, in order to avoid throwing the weight of the trains too much upon one side of the track, bridges, etc. It is estimated that the entire cost of the change of track and rolling stock gage, including incidental expenses, will not be less than a million and a half of dollars.

The Flux Motor of Signor Tommasi.

The Emperor of Brazil has, according to our English exchanges, been much interested in a new motor invented by Signor Tommasi, which combines the use of the ebb and flow of tides with compressed air.

The power of the flux motor consists in the tension and rarefaction of the air produced, by the weight of the water of the sea raised by the tide, in a recipient having two divisions or compartments communicating with the sea. The compressed air acts upon an engine with the same degree of power steam does, provided it be at an equal tension; and the rarefied air, by permitting the exterior air to exercise a pressure proportionate to its rarefaction, enables it also, in its turn, to act with an equal degree of power. The flux motor is essentially composed: First, of a reservoir, by which the power is produced, which is to the flux motors what the boiler and its accessories are to steam engines. Second, of a motive apparatus, constructed, with some slight modifications on the principal of a stationary steam engine. Should a company undertake the expenses of instalment, and let out to manufacturers the motive force, at so much the cubic meter, in the same way as is done with gas, the manufacturers would be saved the enormous expense of boilers, which have to be renewed every ten years, the insurance premium, both against fire and explosions, the wages of the mechanics and stokers, and the cost of coal, which will necessarily become dearer in proportion as the mines become exhausted; and they will have to pay only for the motive force of which they have made effective use. The motive force of the flux motor may be applied to all kinds of industry, even to those where, on account of the inflammable nature of the substance to be worked, it is impossible to use steam. It is not affected by atmospheric variations, such as arise from decrease of water in rivers and waterfalls, and, moreover, it can never fail in its effects.

The idea of using the water force developed by the rise and fall of tide water, is quite old, and various forms of tidal machinery have been devised. It is common along the Atlantic coasts to place gates, across the mouths of inlets, which open on the rise of the tide, but close on the ebb. The hight of water thus obtained is then used to drive mill wheels in the usual manner.

Spindles for Loom-Shuttles.

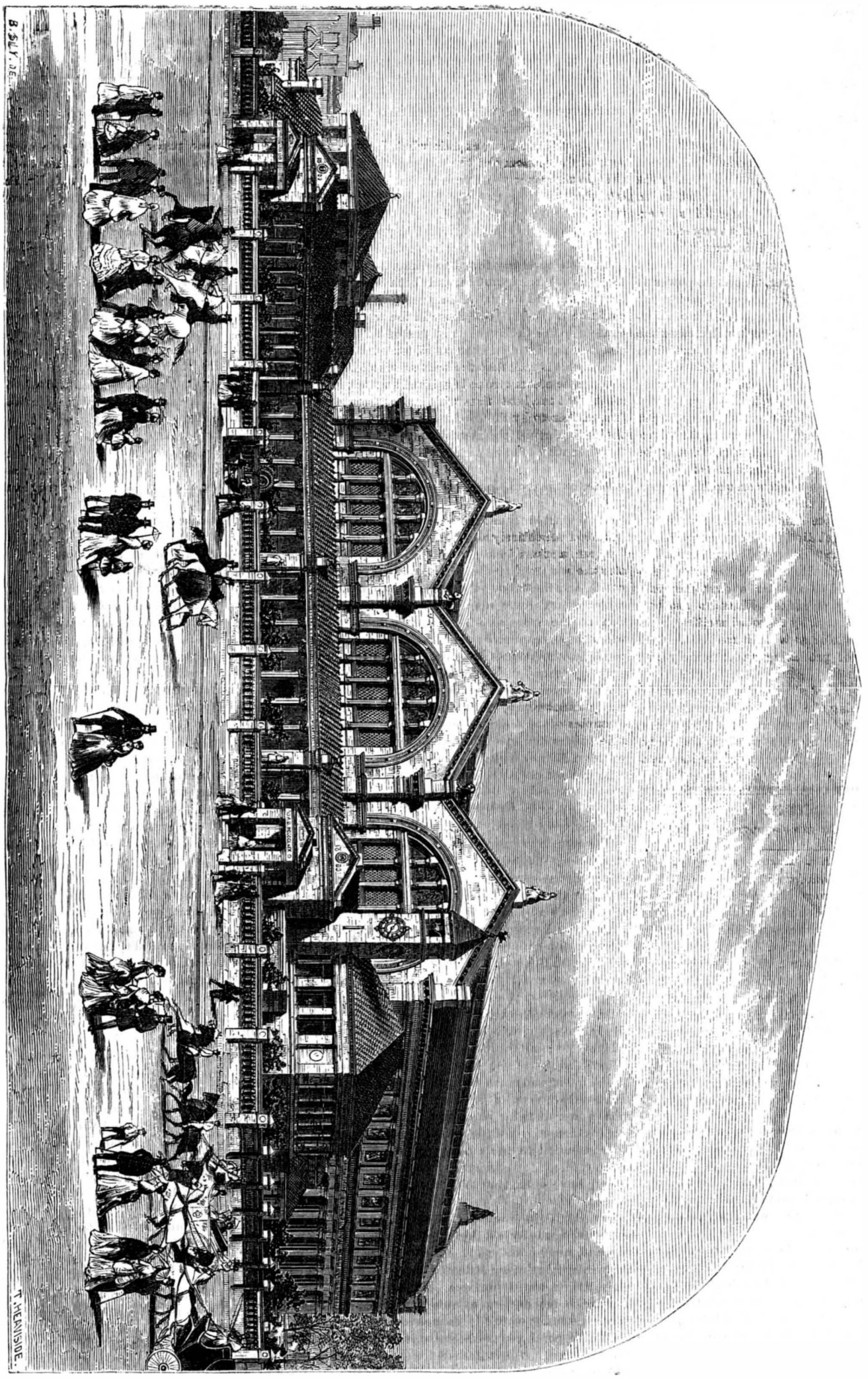
MR. ALBERT MORTON, of Salmon Falls village, N. H., has made an improvement in loom-shuttles, which consists in the application to the spindle of the shuttle of a lever in such a manner that, when the cop or tube is applied to the spindle, it causes the cam or lever to engage it in the interior near the base in a manner to insure the holding of the cop or tube till all the yarn is properly delivered, and prevent the escape of any except in the regular course. A long slot is made through the spindle between the heel and point, nearly its whole length. A long flat lever of steel or other suitable metal, is fitted in the slot and pivoted at a point located at about one third of the length of the lever from the end next the heel of the spindle, and so formed that near both ends it will rise above the upper surface of the spindle. At the end next the heel of the spindle the part so rising is preferably notched or serrated, but not necessarily, for it will answer well without. The spindle and lever are so arranged as to size, relatively to the cop or tube to be put on, that the end of the lever next to the point of the spindle will be forced down sufficiently to raise the other end up to press hard against the wall of the hole through the bobbin or cop, and hold it from slipping off when the yarn becomes slack, when nearly all drawn off, so that the friction is not sufficient to hold it. The lever is also so arranged with the spindle that the weight of the longer arm throws the shorter arm up when the yarn is unwound from the part of the spindle along the long arm, with sufficient power to retain the yarn. Two or more of these levers or cams may be used, if preferred. This improved cop retainer may be applied as well to the spindles of spoolers and other machines.

CUTTING GLASS.—Are any of the numerous inquirers who ask us for simple methods of cutting glass aware that this can be done with a strong pair of scissors, if the cutting be done under water? The edges of the glass can easily be trimmed afterwards by rubbing on a stone.

© 1871 SCIENTIFIC AMERICAN, INC.

THE EAST LONDON MUSEUM OF SCIENCE AND ART.

One of the conditions upon which the English Government agreed to appropriate money for this institution, was a free-hold site, and this, through the exertions of Sir Antonio Brady, the Rev. Septimus Hansard, and others (the Corporation of London and the Fishmongers' Company being among the subscribers), was obtained in Bethnal Green; the title deeds being presented to the Government by a deputation in February, 1859. On this occasion the deputation repeated the views of the promoters as to the nature of the museum which they wished to secure for the East End of London; their leading idea rightly being that it should be educational, in the strictest and widest sense of the term. All the subscriptions had been asked for and given with that understanding; and in making over the land to the Government, the subscribers pressed these views on the consideration of the Government. As regards the study of art, they felt this to be a matter deeply affecting the trade and commerce of the country, and urged it as one of imperial necessity. What they desired was that the museum should be made subservient to technical education generally, and prove not only a blessing to the million at the East End, but a model educational institution for all provincial cities and centers of manufactures to imitate. Earl de Grey and Ripon, as President of the Council, in accepting the deeds, made it understood, that the museum is not a local but a national institution; that it will form, as it were, an outwork of the South Kensington establishment, and will be dealt with upon the principles on which the Committee of Council act with respect to the South Kensington Museum.



THE EAST LONDON MUSEUM OF SCIENCE AND ART

The site is a good one, some 4½ acres in extent, in the midst of a dense population, and thereon the building is being erected. The main body of it, about 185 feet long, and 730 feet wide, is now approaching completion. It has been built under the direction of Lieut. Colonel Scott; Mr. James Wild, architect, mainly assisting in the design. The building is wholly of brick, molded where necessary, and the arrangement of the front marks the tripartite plan. Within there are galleries in the two side divisions and at the end, lighted from the top. The central portion will have a mosaic pavement, made by the convicts at Woking and elsewhere.

Our illustration shows the complete design as proposed, with library on one side, refreshment room and house on the other, with corridors leading to the road; but, it is stated, that the Treasury has just now determined not to erect these—at any rate, at present, the amount granted, £20,000, being nearly expended; absolutely necessary accommodation for attendants and so forth, is therefore to be provided in the basement of the main building.

ZANZIBAR gum is the most valuable for varnish making. Benguela gum stands next in value, and an inferior gum is known as kowrie.

WHAT IS STEEL?

The following is an abstract of a paper read at a meeting of the London Association of Foremen Engineers.

Steel is merely iron steeled or hardened, by being chemically impregnated with carbon, silicon, titanium, or any of those elements which possess more or less the hardening property; chemically impregnated, as the iron does not lose its special qualities, which it would do if the two elements were proportionately and chemically combined so as to form a new compound substance. There is, of course, a definite proportion of the chemically impregnating element, which confers the greatest amount of steeling or hardening property, entitling it so far to be called pre-eminently steel iron, or simply steel, variations from which proportion cause the metal to vary in respect of this property of hardness. According to this view we may regard ordinary cast iron as impregnated with too much, and wrought iron with too little, carbon, in both cases falling short of its strongest form, steel; or cast iron is a mixture of antagonistic steel and wrought iron, which is a very mild form of steel. Thus iron, which, in its pure, simple state, is comparatively soft, is chemically toned by carbon, silicon, or any one of the other elements used in forming steel. This toning may be underdone or overdone, or the different tonics may be all mixed up together, and to modify or neutralize each other's tonic influence. The same toning or hardening influence is to be found in the vegetable world, where we find silicon toning the strength of plants, as, for instance, in the straw of cereals, which is more or less stiff and hard, in proportion to the prevalence of silicious constituents in the soil on which it is grown; the length as well as the quality of the straw being influenced thereby.

The Bessemer process demonstrates distinctly the fact that there is no definite boundary between the three forms; that the percentage of carbon can be very gradually decreased from 1·25 per cent to a percentage scarcely appreciable in practical analysis, without altering the essential properties of the steel, except in lessening the degree of hardness. As the greater the percentage of carbon, up to a certain point, the harder is the metal; so the substitution of a harder impregnating element may be expected to produce a still stronger quality of steel, as, for example, with silicon; or the substitution of a softer impregnating element may be expected to produce a weaker quality, as with phosphorus; and this really seems to be the case. Carbon steel, however, is the kind in general use, and the only one whose qualities have been subjected to practical investigation. It is not only the proportionate amount of the carbon with which it may be impregnated that determines the hardness of the steel; for the same metal can be tempered, or have its hardness moderated.

Crystallization plays a necessary part in imparting the steeling or hardening property.

This is obvious in the practice of hardening steel by plunging it suddenly into cold water, by which it can be rendered so hard as to be capable of scratching glass. So also, on the other hand, an extreme degree of hardness may be reduced to almost any degree of softness by heating the steel. All the gradations are beautifully marked on the bright steel in deepening rainbow tints, guiding the manipulator by visible signs as to the relaxing temper of the metal.

The first tinge of yellow indicates that the steel has barely begun to soften, though it has materially increased in toughness. As the yellow deepens towards orange, the color indicates the degree of temper required for such articles as razors, penknives, and tools for turning, planing, chipping, and boring.

As the orange deepens, the color indicates a temper suitable for joiners' edge tools and table cutlery. When the changing color runs into blue, a temper is indicated that fits the metal for springs, and when it has completed the revolution and arrived at the color from which it started the metal has become nearly as soft as before it was hardened.

It is pretty evident that the relaxing temper of the metal is associated with a chemical action of the heat on the crystalline molecules of the iron. This action is, as yet, not very well understood. It depends not only on the nature of the crystallization of the iron, but probably also on the determination of the axial direction in which the crystals are formed. Only the finest iron is used in making the good steel, and the purer the iron the larger the crystals, but the quality of

© 1871 SCIENTIFIC AMERICAN, INC.

the steel depends also greatly on the amount of carbon, and the chemical admixture of a foreign element reduces the size of the crystals.

The finer the steel the closer will be the grain of the fracture. This brings us to another phase of the question, what is steel? It may come before us in another form. How can steel be identified? How can its varying qualities be distinguished? This is the practical bearing of the question for those who have to realize it by inspection, and on correctness depend very important consequences. Supposing a piece of steel to be submitted for inspection, how can we test its character? If it be a steel rail it ought to contain one half per cent. of carbon. If it be a mild steel casting, it ought to contain about three quarters per cent., and if it be a piece of hard cutlery about a quarter to one-half per cent.

Of course the most correct estimate would be formed by analyzing the steel chemically, but that cannot be resorted to in the rapid turn-out of a factory, to any great extent. The nearest practical approximation to this is to dissolve a small piece of the steel in an acid, when the differing shades of brown will indicate the inherent proportions of carbon. Steel may also be tested as to its proportionate quantity of carbon by ascertaining its specific gravity, as the greater the proportion of carbon the less dense will it be found to be. The readiest method of testing the quality of steel is by examination of the fracture in a microscope. This requires considerable experience and a very powerful instrument. The unassisted eye may make a tolerable guess, but the result cannot be relied upon. Not so, however, where its power is multiplied by the powerful lens of a microscope. The crystals are found then to be octahedral, presenting the form of a double pyramid, joined base to base. As the carbon decreases the pyramids become flatter, from the cubical form in cast iron down to the flattened form in wrought iron, which confers upon it greater capacity of being welded, and thus producing fiber. Between these extremes may be found a graduated series of pyramidal forms more or less elevated, according to the quality of the metal. If the steel shows under the microscope a regular and parallel crystallization (which may be pretty accurately ascertained if the fractured metal be held against the light), flashing back to the eye an uniform luster, like evenly serried needle points, the steel is of good quality. In proportion as it departs from this standard and shows groups of crystals whose diskal directions are not parallel, causing the needle like fragments of crystals to reflect a luster, patched here and there with shade, imparting to one portion a bright silvery tone, and to another a dark grey one, the metal is of inferior quality or make. Fineness and parallelism of grain can be produced by repeated melting, heating, or hammering, when cold or at a dull red heat. Cold hammering has the effect of producing an extremely fine grain.

A more correct estimate of what steel really is has had the effect of materially shortening the process of manufacture. The material itself has been made for upwards of 2,000 years, but only now, in the latter part of this wonderful century, has its manufacture been developed so as to show its capabilities.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Compound Engines---Mr. Emery's Reply.

To the Editor of the Scientific American:

I have but just found leisure to pen a reply to the pointed, but courteous, editorial inquiries contained in the SCIENTIFIC AMERICAN of June 3, and relating to a paper I had previously read on the subject of compound engines.

The communication to which your article refers, namely, that of Mr. Harrison in the previous number of May 27, is a valuable one, as it acquaints your readers with facts difficult to obtain; and the example of Mr. Harrison in publishing his observations might be followed with advantage by many of your readers. Allow me, however, to take up the discussion of the facts where he leaves it, to do which, understandingly, and avoid repetition, I must request your readers to again examine the numbers of your paper of the dates above mentioned.

Mr. Harrison concludes, from calculations founded on the indicator diagrams, that if the steam supplied to the two cylinders of the "Magellan" had been used in the smaller of the two, and exhausted directly to the condenser, the addition of the large cylinder would have produced a gain of 19 per cent in power after deducting the estimated loss by additional friction.

This is doubtless true, but is foreign to the subject; for, let us suppose the steam to be used only in the larger cylinder, with the same initial pressure and measure of expansion as in the two cylinders. From the diagrams we find that the mean initial pressure was 47 pounds, and that the steam was expanded 1·29 times by wire drawing, and 2·2 times by the cut off on the small cylinder; also, that this expanded steam was again expanded 2·57 times by the difference in volume of the two cylinders, so the total expansion was $1{\cdot}29\times2{\cdot}2\times2{\cdot}57=7{\cdot}29$ times. [It will be observed, however, that the terminal pressure is lower than is due to the measure of expansion].

Now, if the steam used were let directly into the large cylinder and expanded 7·29 times, the mean total pressure by the usual rules would be 25·3 pounds, and deducting 4·3 pounds as ample for back and friction pressures, the remaining pressure, namely, 21 lbs., would be effective, and the power would be (using Mr. Harrison's figures) $\frac{21\times7224\times7{\cdot}50\times56}{33000}=$ 1930·8 horse power, or (1930·8—1659·8=) 271 horse power greater with the single cylinder than when both were used. This difference would, however, in practice, be much less as, with similar valve gear, the diagrams would be similarly rounded and modified in both cases, and the only difference would be that due to the loss of pressure required to transfer the steam from one cylinder to the other, or roughly about 75 horse power by the diagrams shown.

This review exemplifies the statement in my paper that "there is no gain in power by the addition of the small high pressure cylinder of the compound engine, for the effective pressure upon its piston is only the difference between that of the entering steam and that admitted to the second cylinder. There is, in fact, a little power lost in transferring the steam from one cylinder to the other." This loss in the case of the "Magellan" was about 75 horse power, or 4½ per cent of the net power exerted.

The indicator has heretofore been considered a faithful guide, but in this case it shows a loss of 4½ per cent against the compound engine when, in fact, such engine was actually saving fully one third the fuel as compared with the performances of other engines.

I do not think I can explain what I consider the true reasons of the economy of the compound engine in fewer words than in the paper you have referred to, and I trust you will consider the subject of sufficient importance to publish such paper in full in your journal.

In reply to the question asked in yours of June 3, I will say, first, that the glass and iron cylinders experimented with were both carefully felted to eliminate all condensation due to external refrigeration, and both cylinders being of the same size, and operated in precisely the same way, there could be no possible difference in the work done except that caused by the different quantities of steam in motion on account of the internal changes of temperature.

Again, it is true that the heat abstracted from the cylinder during the steam stroke is utilized as work in the expanding steam, but the heat thus withdrawn from the metal is returned thereto by the condensation of the entering steam at the beginning of the next stroke; and this condensed water, together with that resulting from the work done, is what is partially evaporated during the expansive portion of the stroke, but is more completely evaporated at the moment of the exhaust and throughout the return stroke, when all the heat abstracted from the metal to produce such evaporation is, of course, entirely wasted.

Again, a steam jacket produces economy because it evaporates the water from the interior surfaces as fast as it deposits, and therefore no water is left to be boiled by actual contact when the exhaust takes place. The losses by radiation at the moment of exhaust will still obtain, however, when the expansion is carried so far that more water is suspended in the steam inside the cylinder than the jacket can evaporate during the expansive stroke.

All discussions on the subject of the compound engine are really unnecessary, as the results obtained with the better examples of this class of engine show them to have remarkable superiority, and of this fact I trust ere long to convince you, Mr. Editor, with some compound engines of my design.

New York city. CHAS. E. EMERY.

Mr. Paine and his Detractors.

To the Editor of the Scientific American:

The great inventor, whose engine was so long in operation at Newark, N. J., whose achievements have satisfied so many of our greatest scientists, and for whom still greater successes are waiting in the future, has suffered the usual fate of the pioneer of invention, namely, detraction and calumny. Mr. Rowland more than hints at a surreptitious connection between the Paine motor and a steam engine in the same building. I think this insinuation is unworthy of a scientific investigator, and it is not to be wondered at that Mr. Paine has passed it by, no doubt thinking it beneath his notice.

Dr. Vander Weyde, another scoffer, has demonstrated that all Mr. Paine's results amount to the discovery of the perpetual motion; and although the Dr. intended to show a *reductio ad absurdam*, Mr. Paine's disciples will consider that Mr. Paine has as much right as anybody else to solve the tremendous problem of building a machine that shall create more power than is required to drive it. Now, while your readers are engrossed in the controversy, and are straining their attention to the coming demonstration, the newly discovered force of psychic power comes upon us. May not this agency have something to do with the motion of Mr. Paine's apparatus?

Even Mr. Paine's warmest admirers, knowing how logically and systematically all his experiments and reasonings are pursued, may hesitate to claim for him the honor of inventing the perpetual motion; indeed, with characteristic modesty, he himself deprecates the idea. But then the question arises, how is the mechanism operated? "How," as the boys say, "does the thing work?" I am driven to the conclusion that Mr. Paine, perhaps unconsciously, is the real discoverer of the psychic force, and that the results, the remarkability of which no one can deny, are to be credited to the mental power, courage, and indomitable will of the great inventor of Newark. I am strengthened in this belief by the visible fact that Mr. Paine's power augmentor (for that is the proper name for his invention) must be driven by some such agency. Mr. Home does more with a slight touch of his finger tips than strong men can do with the whole strength of the muscles. And a similar phenomenon must cause the motion of the Newark engine, whose running powers are otherwise inexplicable, and which must have considerably startled Mr. Paine when the machine first ran away at an unexpected pace.

The unfortunate persons called spiritualists are now about to receive the reward of their patience and long suffering. They have been taunted with the uselessness of their manifestations, and asked, if it be possible that spiritual power can find no better employment than turning hats and upsetting tables. These sneers will now cease, as a direct mechanical force, available for all purposes, has been demonstrated by Mr. Home, in the presence of witnesses of acknowledged honesty as well as intelligence, to exist in the mind of a highly gifted spiritualistic medium. If Mr. Paine's motor be the great want of the future, the apparatus that shall allow us to utilize, to direct, and to govern this omnipresent power, he will have obtained a reward for the years of patient investigation he has devoted to his invention. A far greater renown than that of discovering the self-moving machine will be his; and the sarcasms of all Vander Weydes, Rowlands, Smiths, and other extraneous and superfluous persons, will be silenced for ever. B. D.

Jersey city.

Paine's Electro-Motor.

To the Editor of the Scientific American:

I have read with a great deal of interest the articles in your paper on Mr. Paine's electro-motor, and rather impatiently await the settlement of the whole question by the production, on the part of Mr, Paine, of a machine actually performing the work he claims for it, or its partial settlement by his failure to do so. I say *partial* settlement, for it seems to me that the question, whether such a machine as he claims to have knowledge of is or is not among the possibilities, would still press for solution, even should he totally fail to produce it. In the absence of a machine doing the work, the controversy must remain unsettled just so long as one palpable fact obstinately persists in existing. Allow me to explain by giving an example:

Place an electromagnet in the circuit of a current just sufficient to suspend, say, ten pounds in actual contact. Now break the circuit, and complete it again by placing in it another magnet precisely like the first, and either the current will suspend twenty pounds with no increase, or with only a very trifling increase. I know of no analogous fact outside of the phenomenon of magnetism. It is like getting one hundred horse power out of a fifty horse power engine by throwing an extra shovelful of coal in the furnace. It is like making a water wheel which operates a fifty horse power mill operate two such mills by throwing an extra bucketful of water into the mill dam. It is like a man who could resist the pull of an equally strong man being able to resist the pull of two such men by eating an oyster. The theory of the conservation of force is much talked of, and I have a profound respect for that theory, and for the processes of critical investigation which have been employed to produce it. But that theory is in no way interfered with in the electromagnetic phenomenon, unless it is insisted that the electric current produces the magnetic force, in which case the theory of the conservation of force would be overthrown. My mind can make nothing else out of it. If the electric current is the cause of the magnetic force, if it is changed into it by any imaginable process, then the facts in the case disprove the the theory. But it is a gratuitous assumption to insist upon any such transformation. Why may not the force or forces of magnetism always exist in the bar of soft iron, totally independent of the electric current, but in a state of equilibrium which that current disturbs? and while so disturbed, force be manifested which overcomes other forces, gravitation for instance, and which can be used for mechanical effect? The magnetic force in such bar of soft iron might be aptly likened to a train of loaded cars on an inclined road, with a stone resting on the track and blocking one of the wheels, and which stone had a tendency to always get under the wheel and stop the train unless forcibly prevented. Now the electric current knocks out that stone, and the train moves with a force entirely disproportioned to that which was required to move the "scotch," and it keeps moving as long as the stone is held out. If we now suppose an indefinitely long track, the breaking of the current merely stops the train. If we suppose a limited track, and the current be broken when the train had reached the lower end, then not only is the train stopped, but returned by great Nature to its starting point, ready to perform once again its work. It is like an infant pulling the "trigger" of a cannon, with Nature to replace the load. If the character of the magnetic force be ever understood, there may be known the breservoir from which its vitality is replenished. Whether there be such reservoir is now hidden in impenetrable darkness; at least, so it seems to me.

I am totally unacquainted with Mr. Paine; he may be a perfect charlatan, so far as I know; but is not the above mentioned fact of electromagnetism basis enough to sustain his wildest assertions? A very little reflection will show that this force makes possible a practically unlimited and costless mechanical power, so far as the destruction of values is concerned, in obtaining the initial current of electricity. Whether it is or is not a perpetual motion has nothing to do with it, so far as I can see, and the conservation of force is in no way disturbed by it, in our present condition of ignorance. To obtain millions of foot pounds from the consumption of grains of zinc may be Utopian, but in this case the foot pounds are obtained from the magnetic force. The grains of zinc pull the trigger, while Nature tends to the reloading.

I once heard Professor Smith, of the University of Virginia declare—and he performed an experiment before my eyes to prove it—that a small block of platinum, the densest of metals, had the power of stowing away within its own body, while under the influence of the electric current, a prodigious quantity of hydrogen gas, a quantity so great that no known mechanical force could succeed in compressing it into an equally small compass. This metal, he declared, seized the hydrogen and forcibly stowed it away within the

© 1871 SCIENTIFIC AMERICAN, INC.

capacious recesses of its own body by a molecular energy of which we had very little conception. This may be somewhat akin to the magnetic action; but whether it is or not, I am waiting for some mechanical expert to convert this immense energy into available mechanical force. That the force is there, the plainest facts unmistakeably indicate, and some Watt, Fulton, or Morse will in time seize the thread which will lead out of the labyrinth into light; and when he appears, we will all help him go into glory. J. LANCASTER.

Baltimore, Md.

Steam Boiler Explosions.

To the Editor of the Scientific American:

Allow me to ask you: Is it not lamentable to see how little is known, by men who call themselves expert engineers, of men who claim to have had many years experience in the management of steam boilers? And to hear their various opinions, and see how ignorance holds its sway amongst the majority of those who are entrusted with the care of steam boilers?

I have no pet theory—electric, gaseous, or expansion—to discuss, nor do I expect to tell you anything about boilers or the generation of steam, that you do not already understand fully; but if you will allow me to address a few remarks through the medium of my favorite paper, the SCIENTIFIC AMERICAN, to the owners of boilers and the men who have charge of them, I may be able to set some of them to thinking, and from thinking to acting, and thereby prevent the loss of some lives as well as property.

All men who have anything to do with boilers should know that there is no piece of machinery or article of manufacture that affords facilities for cheating equal to a steam boiler; and if there be no design or intention to cheat on the part of the manufacturer of the iron, or of the boiler, if they neglect to exercise a most rigid supervision over their workmen, the boiler may go to the purchaser, having serious defects which will escape the scrutiny of persons who are well informed, even in regard to the construction of boilers. Then there are men who will agree to make boilers at prices which prevent them from using good materials, or having good work done on them. And there are many who call themselves good boiler makers, who do not know when a boiler is well made; and I am sorry to say there are many more who do not care whether the boiler is well made or not, so long as they get their pay. The malpractice of caulkers, riveters, etc., has frequently been commented upon in your columns, and I need not say anything on that subject. The stronger a boiler is, the better it will resist the sudden strains it will be subjected to every day it is used. But it will not do to depend on the strength of the boiler as a safeguard against explosion, for the strongest of boilers may be exploded, and the stronger they are the more violent the explosion will be, if one should occur. I presume most engineers who know anything, know that water is a very poor conductor of heat. I know of several kinds of boilers from which you may draw water cool enough to wash your hands in, several hours after the fire has been applied and the engine running. Does this not prove that water can only be heated by being brought in contact with the hot parts of the boiler, and that motion or circulation is necessary to enable the water to carry away the heat from the heating surfaces of the boiler?

Messrs. Engineers, have you not frequently observed a heavy thumping and jarring in your boilers when you first start the fires? Have you not seen large and heavy boilers made to vibrate at such times, so that everything about them shook as if shaken by an earthquake? If you have witnessed this phenomenon, did it make you think any, or did you try to inquire into the cause of it? And, gentlemen, do you not know that all of the violent explosions take place in boilers which have had all the outlets for steam closed for a greater or less length of time, and the water having been brought to a perfect state of rest, and then, not until the engine had been started, or the pump put in action or the safety valve began to play? Have you even thought of this? Have you ever asked if the boiler gave way from excess of pressure gradually produced? Why did it not go when the strain was at its maximum, which any one would naturally think was just prior to any steam being let off? Suppose, for instance, that you put a bar of iron in a testing machine, and work the pump until you have a strain of 70,000 lbs. to the square inch of section; then let the pump down until you have reduced the strain to 65,000 lbs., would you not be very much surprised to see the iron break at that stage of the experiment? Yet it seems that boilers do explode after being relieved of part of the steam they had safely resisted a few seconds before. And have we not abundance of proof that many boilers have exploded with a full supply of water in them? Is it not a positive fact that the more water there is in a boiler, when brought to a state of rest, the more liable it is to explode, and the greater the destruction will be if it does explode? For, are you not aware that when there is no steam escaping or being drawn from the boiler, that there is no ebullition within the boiler? That the water is perfectly calm and still, no matter how hot your fire is? And do you not know that water will not remain in contact with iron when the temperature is 400 degrees Fahr. or even less? If you have made yourselves familiar with these facts, has the remedy not suggested itself? A great deal has been said about the engineer—I presume I must call him by that name—of the *Westfield* carrying 27 lbs. instead of 25 lbs. steam, and a great many people are satisfied that was the cause of the explosion; but it was not the cause. I will take charge of a boiler in the precise condition that boiler was in one hour before it exploded, and run it five days or five weeks, with a pressure of 40 lbs. per square inch. No, the boiler on the *Westfield* was not exploded on account of there being a scarcity of water, nor by an over pressure of steam gradually increased from the pressure indicated by the gage when the boat came into the dock; but it gave way under an instantaneous pressure, the extent of which no man can calculate, but we may guess at it, after seeing the fragments of iron and staunch timbers which were torn to pieces, and by carefully considering the immense weight of matter that was suddenly put in violent motion. There is a class of men—and their name is legion—who still persist in the belief that boiler explosions are caused by some mysterious agency. If any such wish to be enlightened as to what that mysterious power is, let them furnish me with two boilers similar to that on the *Westfield*. And with fire and water only I will explode one and burst the other. The one I will cause to explode shall have three cocks of solid water, and shall explode with as much violence as the one on the *Westfield* did; while the other shall have less water and shall merely burst without moving one foot from where it is placed. And if they are not satisfied with one experiment, I will repeat it as many times as they wish. Let all persons owning or having the care of boilers see that the water does not stand still more than one minute or two at the most, while there is any fire about them, and I will guarantee they will have no violent explosions. Knowing the safety valve to be in good order and the gage to be true, does not insure safety. But keep the water in motion, either by lifting the safety valve, opening the blow cock, or working the pump.

Unceasing vigilance is the price of safety, when dealing with steam boilers, as well as with gunpowder or nitroglycerin. D. A. MORRIS.

18, Platt street, New York.

The Explosion of the Westfield.---What Caused it.---Dangerous Management of Boilers.---Possible Prevention of Violent Explosions.

To the Editor of the Scientific American:

This communication, upon the cause of the *Westfield* explosion, and upon the means to prevent such calamities, aims to exclude all matter not based on known facts, and to point to such precautionary measures only as are supported by well known physical laws and proved by experience.

To present the matter clearly, the following well known facts as to boilers must be kept in mind:

1. It is practically impossible to provide for uneven expansion and contraction in boilers.

2. A boiler cannot be made so strong as to withstand unequal expansion and contraction without deterioration. And its giving way under such circumstances is but a question of time.

3. Red hot iron plates do not make steam faster than nor so fast as plates under usual heat, because intervening steam prevents sufficient contact with the water, as proven by experiments.

4. Red hot "kitchen water backs," sectional boilers, etc., forming receptacles of comparatively small extent, will not burst by the sudden application of water, as proved by experiments.

5. Red hot plates in a boiler act disastrously by causing unequal expansion and great strain, and by the weakness of the parts so heated.

6. Water contains air, which upon ebullition escapes, and leaves the water inclined to "solidify;" that is, to acquire great adhesion of its particles to each other, in which state it resists the formation of steam.

7. Water so deprived of air requires constant circulation to prevent its acquiring heat far beyond its pressure, which excess of heat may amount to over 100° Fahr.

8. When the engine is standing still, the fires are burning, and no feed water is being fed in, or circulation caused in some way, the water in the boiler is in the best possible condition for storing up heat, as named in No. 7, which upon commotion or too great an overcharge of heat, will flash into steam with explosive force.

9. The overheating of plates is not only caused by low water, but it also takes place, in a less degree, in a boiler well filled, when there is no circulation in the same; because water and steam carry heat by convection, very little by conduction; hence without circulation they but imperfectly relieve the plates of heat.

What were the facts in the case under consideration?

Captain Vanderbilt states: "When one of our boats starts from the dock at Staten Island, the custom is to feed from four cocks until Quarantine is reached. There is then more than enough water in the boiler to carry her to New York, and the supply is shut off. It is the engine that feeds the boiler, and consequently no feeding can be done while she is lying still."

Robert Crofton, the fireman, told Vanderbilt that he tried the boiler and found it three cocks full. He then turned to open the furnace door, when he heard a hissing noise. The boiler gave way.

The boiler was therefore without a fresh supply of water (and air) for at least an hour. And the engines stood still, the fires burning with the door shut for over half an hour, or perhaps much longer. In half an hour, the fires, burning at half the usual intensity, would under normal circumstances produce over 67,000 cubic feet of steam at twenty-seven pounds.

As the explosion took place before the boat started, and the adhesion of the water was therefore not overcome by the commotion due to the drawing of steam from the boiler, the mass of the water, or much of it, must have been overheated to its limit or nearly so, flashing into steam by an addition of heat beyond its capacity to hold, and by the action of the safety valve.

What would be the result?

The boiler occupies about 1,900 cubic feet of space, the cylinder having a capacity of 140 cubic feet, the steam room is estimated at about 700 cubic feet, the water space at about 700 cubic feet, and the furnace and flue space at about 500 cubic feet.

Seven hundred cubic feet or 44,000 pounds of water, if surcharged with only an average of 50° Fahr. of heat beyond that due to its pressure, will, upon losing its cohesion, flash over one twentieth of its contents into steam, amounting to 22,000 cubic feet of steam at twenty-seven pounds pressure, the steam space being only 700 cubic feet, and already filled.

The safety valve was blowing off violently, as explicitly testified to by H. R. Hale, who left the boat on acccount of the noise, to be able to speak to a friend. That valve had twenty-eight square inches area, capable of blowing off 1,120 pounds of steam per minute, or 190 cubic feet per second at twenty-seven pounds pressure (above the atmosphere), more than three times as much as the boiler is capable to produce within that time without accumulated heat. But this valve, or any valve, is totally incapable of passing off 22,000 cubic feet of steam, produced by released accumulated heat in a moment of time.

The question is, why does this not happen frequently, as this practice is unfortunately not solitary? The answer is, that if, under the figures above assumed, the boiler could have withstood seventy-five pounds of pressure which consumes 50° more heat than twenty-seven pounds, no harm would have arisen.

It is, however, more than likely that even with only a few degrees of accumulated heat, the sudden explosion of water into steam, assisted by the momentum of the masses suddenly set in motion, may cause a momentary violent strain upon the boiler, which a second after is scarcely perceptible upon the pressure gage. The latter may not even indicate but imperfectly the sudden strain in the boiler, by reason of its suddenness, and the small and often tortuous communication to the gage.

Circulation should always be provided for, particularly while the engine is standing still, either by the feed pump (independent pump) or otherwise. And if the pump is to be stopped, let it rather be done while the boat is under way.

If circulation be preserved, the water will not accumulate heat, but will evaporate as fast as it receives heat. Without circulation comparatively little steam is made, and the safety valve does not blow off until after the water is fatally overcharged with heat—too late to notify the fireman to open the furnace doors.

Without proper circulation the steam may be much hotter than the water, or the water hotter than the steam, while the boiler plates become unduly heated and weakened, with the final fatal result sure to follow continued unequal expansion, if the injury caused by it is not discovered in time.

While the most careful boiler inspections are thus of the utmost importance, and indispensable, they do not give entire security against explosion from the cause named; and the less so, the greater the mass of water in the boiler. And safety valves in such case lose their efficacy.

How often our lives thus hang "but by a thread," while taking passage on our boats or in passing over sidewalks and by houses hiding away thousands of boilers from view, we fortunately do not know. ROBERT CREUZBAUR.

Williamsburgh, N. Y.

Psychic Force.

To the Editor of the Scientific American:

The names of Professors Crookes and Higgins are guarantees for the genuineness of the experiments, described and illustrated in your issue of August 12th; and the investigation is thus narrowed to the question of the origin and nature of the force, the existence of which cannot longer be doubted. And there seems to be great probability that evidences of the existence of this force are of daily occurrence, and are so familiar to most men that we wonder that enquiry as to their cause has not been pursued before. But most new discoveries of this kind are found to be exemplified under our eyes, no man regarding them.

We are all familiar with the fact that, in times of necessity, danger, and otherwise when under great excitement, a man can execute feats of strength which are impossible to him in moments of mental calmness and repose. Instances of the exertion of power, far exceeding the capability of the muscles, will occur to the memories of most of your readers. What are these but exhibitions of Psychic Force, a dynamic power proceeding from the will of man, purely mental in its origin, unconnected with and unaccountable for by any physical power of the doer? D. B.

New York city.

Mr. Paine to Mr. Smith.

To the Editor of the Scientific American:

I have only time to say, in your present issue, that Mr. Smith's last article is a tissue of falsehood and misrepresentation, as will be abundantly proven in your next.

H. M. PAINE.

Newark, N. J.

THE Life Companies doing business in New York in 1870 had capital stock amounting to $10,768,483; received income of $106,586,226; paid on lapses and surrenders, $9,625,687; and on losses, $19,675,880; expenses of management, including taxes, $18,307,724. During the year, 235,706 policies, covering $567,929,471, were issued. At the close of the year, 775,381 policies were in force, covering $2,081,270,843. This shows a decrease in the amount of business of 14 per cent. Only three companies seem to have escaped this decrease.

© 1871 SCIENTIFIC AMERICAN, INC.

W. H. WINDSOR'S PRINTER'S CHASE.

We not long since illustrated an improved printer's chase devised by a French inventor, in which clamping bars were made to advance and compress the types by the direct action of screws. We herewith give engravings of a still more simple method invented by W. H. Windsor, of Little Rock, Ark., and patented through the Scientific American Patent Agency, May 30, 1871.

The invention combines with simplicity great power of compression, ease in working, strength, and durability of parts, and merits the attention of practical printers.

The construction and operation of this chase will be readily understood. The outer iron frame has a re-entrant angle at A, as shown. This enables the chase to be made enough wider on two sides, to make room for the locking screws, B, which extend across the chase on two sides, as shown, and are provided with strong durable threads, and well finished hexagonal heads, to which the locking key or wrench is applied.

Fig. 1

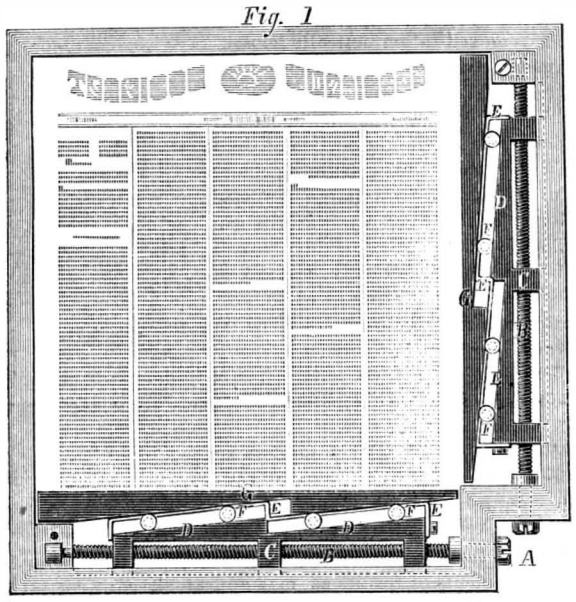
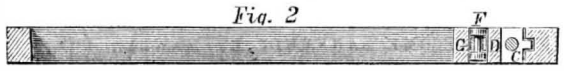


Fig. 2



These screws are held stationary by suitable collars, and run in female screws, C, formed on the side sticks, D, each of the latter having one or more inclined planes formed on its inner side as shown.

A bent guide bar, E, is also attached to each of the side sticks, D, which bar serves to hold in place friction rollers, F; these rollers having grooves turned in the middle, into which the guide bar fits. The side sticks, G, having inclines reversed to those on the side sticks, D, complete the apparatus.

It is obvious that turning the screws so as to force the higher part of the inclines on D, toward the higher part of the inclines on G must cause a powerful movement of the latter towards the type to be compressed, the principles of the screw and inclined plane being combined, and the friction being greatly reduced by the friction rollers, F.

The lugs containing female screws on the side sticks, D, have tenons which run in grooves in the side of the chase, as shown in section, Fig. 2, and in dotted outline, Fig. 1.

For further information address W. H. Windsor, Little Rock, Arkansas.

SHAW'S COMPOUND PROPELLER PUMP.

Up to the present, the Cornish pumping engine has been considered as far the most efficient machine for elevating water from mines, or for raising large volumes of water for purposes of irrigation or the supply of large cities. But while its efficiency is acknowledged, its great cost has been a standing objection to it, especially in this country where large enterprises are often begun with comparatively limited capital; and where, consequently, first cost is often a matter of greater importance than current expenses. On this account a field has been opened for the employment and sale of many machines less economical in running than the Cornish engine, but costing much less at the outset.

It has been the constant struggle of the inventors of the cheaper class of pumps to approximate as far as possible in economy to the Cornish engine, and assuredly a very fair measure of success has been attained. We this week illustrate a powerful pump placed in exhibition at the Novelty Iron Works, 745 East Twelfth street, New York, by General H. S. Lansing, and which is certainly worthy of most careful examination by those interested in such matters.

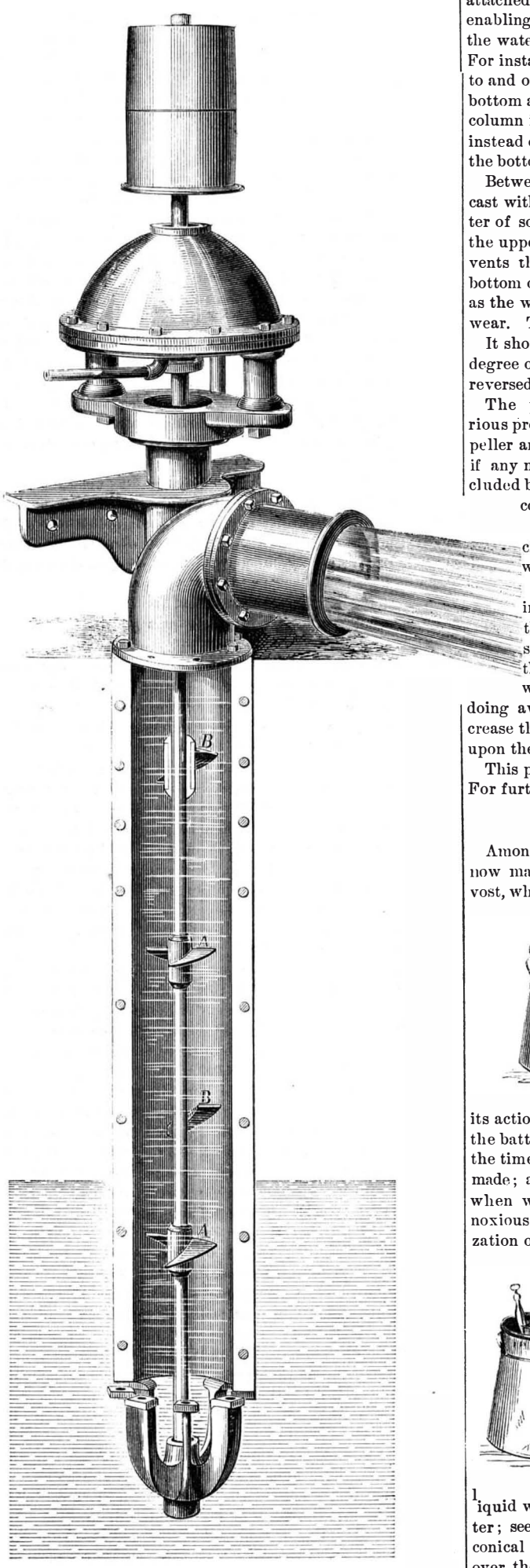
Various sizes are shown working, the largest being twenty inches in diameter, asserted to be capable of lifting 14,000 gallons of water to any hight per minute, with an expenditure of 1 horse-power to every three inches of elevation. We made no test to corroborate this statement, but the pump was evidently delivering a very large quantity of water; and we were offered opportunities to test its capacity, but had not time to avail ourselves of the offer.

Another pump, seven inches in diameter, was raising a large body of water 43 feet. Its discharge was stated to be 1,000 gallons per minute. This pump requires one horse-power to every 42 inches of lift.

A third pump, 1¼ in internal diameter and ten inches long, to which a short hose was attached, threw a powerful stream up through a skylight window to a considerable hight above the building. This pump a boy could have carried away in his hand.

The power consumed by friction of working parts is very slight, as the main shaft with its propellers and pulley are suspended on a water bearing of peculiar construction, of which we shall say more in describing details. The amount allowed in the above statement is about one eighth, which we consider large.

The following advantages appear to belong to this pump in addition to its great delivering capacity.



Its construction is extremely simple. It has no valves, and consists only of the column pipe, shaft and propeller. It can be used in any position, vertical, horizontal or oblique, either as a force pump or lifting pump. The small pump above alluded to as working with hose attached, was placed in a horizontal position. The first cost of this pump is very much less than any other of the same power with which we are acquainted, and we judge its utilization of power in work is fully up to that of the better class of pumps. It carries through sand, sticks and rubbish without interruption of its working, there being no valves to clog. In this particular it appears to be admirably adapted to use on ships; no amount of wet grain could choke it. The water bearing, above alluded to, prevents the necessity of oiling. Lastly, it will raise water to any hight.

Our engraving illustrates the seven inch pump, which is in every essential particular like the other sizes. The vertical shafts are shown suspended on the water bearing. This consists of two disks of peculiar construction, between which water is forced by a donkey pump, the water escaping at the outer edge, and passing between the disks in a thin film which effectually separates the solid surfaces. Those familiar with the application of this principle to turbines will need no assurance as to its effectiveness in the reduction of friction in this class of machines. The construction of this water bearing admits of its being placed above or below the weight it sustains. This is an important advantage so far as this pump is concerned, for it allows the pump to be driven by a pulley attached to either the lower or upper end of the shaft, thus enabling the motive power to be placed on the same level as the water to be lifted, which is in many cases very desirable For instance, this pump could be made to pump water up to and over into the top of a stand pipe, instead of into the bottom as now practiced; thus allowing the full weight of column in the stand pipe to transmit its pressure to the mains instead of acting against the current of inflowing water at the bottom. The vertical shaft carries screw propellers, A.

Between each two of the propellers is placed a fixed rest cast with and upon the column pipe, as shown. At the center of some of the fixed rests are found bearings as shown at the upper part of the engraving, which in long pumps prevents the lateral springing of the shaft. The step at the bottom of the shaft also acts more as a guide than a bearing, as the water bearing above relieves it from pressure and wear. The shaft is driven by belt and pulley, as shown.

It should be observed that the fixed rests have the same degree of pitch as the propeller screws, but that the pitch is reversed in direction.

The precise way in which this arrangement acts is a curious problem. Pressure gages show that between each propeller and the next in succession, the lateral pressure is little if any more than that due to the length of the column included between the two screws, and that this is pretty nearly constant at any part of the column.

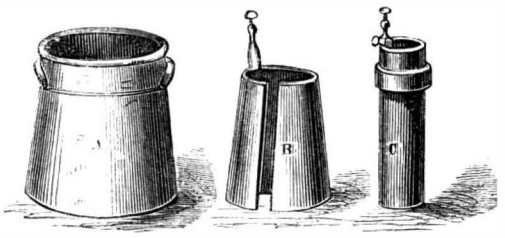
We are informed that this pump has proved its efficiency in pumping mines, raising vessels, etc., and that wherever used it has given the greatest satisfaction.

This pump could be made the means of procuring, for Central Park, fountains second to none in the world, at a current cost far less than that of many similar fountains in Europe. We are informed that the proprietors have offered to supply Philadelphia with water at half the cost of the present supply, doing away entirely with the present works; and also to increase the supply to double the present amount. This we state upon the authority of several prominent dailies of that city,

This pump was patented by Thomas Shaw, Feb. 15, 1870 For further particulars, address Gen. H. S. Lansing, as above

EMILE PREVOST'S NEW BATTERY.

Among the numerous improvements in electric apparatus now making their appearance, is the battery of Emile Prevost, which is claimed to act as soon as charged, and to cease



its action when the electric current is cut off, without taking the battery to pieces. The battery incurs no expense from the time the circuit is broken until the connection is again made; and, it is asserted, is always ready for immediate use when wanted. A further advantage is the absence of all noxious or offensive fumes, and the preservation from oxidization of the small connecting pieces between the carbon and the zinc.

The form of the battery is similar to the famous Bunsen cell, with the exception that, in the Prevost battery, a hollow cylinder of carbon replaces the porous cup of Bunsen's.

The three elements of the Prevost battery are: first, an earthen or glass jar, A, into which water, slightly impregnated with sulphuric acid, is poured until the liquid weighs three degrees according to Beaumé's acidometer; see accompanying engraving. Second, a zinc, B, whose conical form presents, it is claimed, a notable advantage over the old fashioned straight zincs; and third, a hollow cylindrical carbon in which Barjon's new patented acid is employed as a substitute for nitric acid; an india rubber lining being set round the carbon at the top and on the outside, to isolate it from the zinc.

The patent for the battery bears date July 7. 1871. The battery fluid alluded to was patented by V. Barjon, July 11, 1871. This is furnished, in carboys, to purchasers. It is very highly spoken of by those who have used it.

The Prevost battery has been assigned to Mr. Barjon, who now undertakes to fix large surface batteries for telegraph companies, for the economical production of electric light, for gilding and silver ware manufacturing.

Further information may be obtained by addressing him at No. 36 Amity street, N. Y.

M. SOMMELLIER, contractor for the construction of the Mont Cenis tunnel, is dead.

© 1871 SCIENTIFIC AMERICAN, INC.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW (PARK BUILDING) NEW YORK.

O. D. MUNN. A. E. BEACH.

☞"The American News Co.," Agents, 121 Nassau street, New York.

☞"The New York News Co.," 8 Spruce street, New York.

☞A. Asher & Co., 20 Unter den Linden, Berlin, Prussia, are Agents for the German States.

☞Messrs. Sampson Low, Son & Marston, Crown Building, 185 Fleet street, Trubner & Co., 60 Paternoster Row, and Gordon & Gotch, 121 Holborn Hill, London, are the Agents to receive European subscriptions. Orders sent to them will be promptly attended to.

VOL. XXV., NO. 8 .... [NEW SERIES.] *Twenty-sixth Year.*

NEW YORK, SATURDAY, AUGUST 19, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

A Great Railroad Feat..... 114
Alvan Clark and his Telescopes.. 112
American Coach Painting..... 120
A New Bleaching Process 120
A New Idea in Safes..... 121
Answers to Correspondents..... 121
Boiler Explosions..... 119
Business and Personal..... 122
Combined Rubber and Copper Wire..... 112
Combustibility of Diamonds..... 119
Compound Engines. Mr. Emery's Reply..... 116
Cutting Glass..... 114
Dish Washing Machine..... 112
Electrical Organ Blowers and Sewing Machine Motors..... 120
*Emile Prevost's New Battery.... 118
*File Cutting 111
Gripers for Printing Presses..... 112
How Crude Rubber is collected... 113
How to become Bankrupt by Manufacturing 119
*Hydraulic Buffer for Checking the Recoil of Heavy Guns.... 114
Improved Can for Nitro Glycerin 112
*Improved Printer's Chase..... 118
Inventions Patented in England by Americans 124
Iron Telegraph Poles 112
Meeting of the New York Canal Commission 121
Mr. Paine and his Detractors..... 116
Mr. Paine to Mr. Smith..... 117
Official List of Patents..... 123
On the Gaseous and Liquid States of Matter..... 113
Overland Telegraph between Asia and America..... 120
Paine's Electro Motor 116
Propulsion by Steam on Canals.... 113
Psychic Force 117
Queries 122
Recent American and Foreign Patents..... 123
Rejected Correspondence..... 122
*Shaws Compound Propeller Pump 118
Special Correspondence..... 121
Spindles for Loom Shuttles..... 114
Steam Boiler Explosions. 117
The approaching Fair of the American Institute..... 120
The Disposal of Sewage..... 119
*The East London Museum of Science and Art 115
The Explosion of the Westfield... 117
The Flux Motor of Sig. Tommasi. 114
The Manufacture of Albumen..... 112
The Patent Agency Business..... 120
The Westfield Explosion 121
Use of Silicate of Potassa in Strengthening Skeletons..... 112
Vinous Fermentation..... 113
What is Steel?..... 115
Why Circles Please the Eye..... 113

BOILER EXPLOSIONS.

While the Coroner's inquest on the recent disastrous explosion on the steamer *Westfield* is in progress, and the various experts and inexperts are airing their theories of boiler explosions, the public stands in dismay, breathlessly asking whether, with so many causes for the violent disruption of boilers, there is any immunity from imminent danger in travel by steam or in proximity to steam motors.

Surely, if boilers explode through the formation of explosive gases, through external atmospheric influences, through unequal expansion by heat, through bad caulking and riveting, through deficiency in the quality of iron, through not having saddles enough, through being eaten away with rust, through safety valves sticking, though pressure gages getting out of order, through carelessness on the part of attendants, (which last includes a category of causes in itself), etc., etc., it would seem that steam is hardly less dangerous than dynamite or nitro-glycerin, and we had better go back to first principles, restore the old "diligence" and "stagecoach," and give steam boilers a wide berth.

Now some of the above alleged causes are no causes at all, and others are causes only in connection with other things.

The gas theory is itself gas, the atmospheric influence theory will influence no mind except such an one as ought never to meddle with a boiler. Unequal expansion may weaken or even rupture, but alone will never violently explode a boiler; a boiler weakened by caulking, or imperfectly riveted or stayed should show these defects in time to prevent trouble; deficiency in the quality of the iron is a matter inspectors ought to be able to determine, and with a proper system of testing and marking plates could always determine. They also could tell or ought to be able to tell if boilers are set so as to break their backs. Corrosion and channelling are easily discovered faults. Safety valves and gages are certainly within range of observation. Care on the part of attendants can be enforced by low water alarms and other appliances, but more than all by paying a fair price for intelligence, skill, and conscience.

If any of the essentials of safety named are absent, a boiler may either burst, or explode, but whenever it does so, the final cause will be that it has within it more pressure than it can withstand in its condition at the time. If the pressure is applied gradually, it will rupture and leak steam or water or both; if applied very suddenly, it will rend the boiler to pieces which will be scattered as deadly projectiles, followed by water and steam to complete the work of destruction.

We desire to call attention to the letters upon boiler explosions published this week on another page. These letters state clearly some facts deserving the most careful attention at this time. It will be seen that explosions taking place under circumstances such as those of the Westfield disaster are attributed to pressure *suddenly* generated, and the method by which this sudden pressure is generated is well described. Miller in his "Chemical Physics" (Vol. 1, of his excellent treatise "Elements of Chemistry"), states that water with the air expelled from it has been heated to 360° Fahr. in an open glass vessel without boiling, and upon reaching that temperature it suddenly expanded into steam, shivering the vessel to atoms and scattering them like powder. This is an experiment that may be easily repeated; that is, if not with the same violent result, with something sufficiently approximating to it to convince any one that it is dangerous to force heat into still water when the air has been boiled out of it.

Is the experiment ever repeated in steam boilers, and was the Westfield explosion the terrible *finale* of such an experiment on a large scale? We believe it was.

If boilers do thus explode, what is the remedy? Simply to maintain circulation therein, mechanically if necessary, so that the steam will generate constantly instead of by explosive bursts.

While thus supporting the belief of our correspondents in regard to the sudden generation of steam, we would not be understood to say that we think boilers may be overheated without danger, or that neglect of any sort is to be palliated on the part of any one who deals with boilers, from the manufacturer who purchases the iron, through the whole list of workmen employed in building it, down to the man who fires it. But we surely cannot blame attendants for allowing boilers to explode from unrecognized causes, not understood by them nor required by inspectors to be understood by them; and the cause we have named we believe not to be generally understood, though it is in our opinion the most common way in which boilers are blown to pieces.

One word now as to low water alarms. Every steamboat or ship should be furnished with a low water whistle of a kind the sound of which would instantly inform every passenger on board that the water had approached to within a prescribed limit of the line of danger. The screech of that whistle should be the signal of discharge for the engineer who permits it. This whistle should be daily inspected by some superior officer, and a certificate that it is in order should be hung in a conspicuous place where passengers may read it. A pressure whistle should also sound an alarm when the pressure exceeds the limit allowed, and both whistles should be locked up so that the engineer may not tamper with them.

We believe disastrous explosions of boilers need not occur, and that when they do occur they are generally the final result of ignorance, carelessness, or the compelled use of defective boilers through the avarice of owners. As a rule there is blame somewhere, and those who are to blame ought to be punished.

THE DISPOSAL OF SEWAGE.

This vexed question still retains its interest, notwithstanding that it has been discussed at greater length than almost any other engineering problem of the day. We say "engineering problem;" in reality it is a chemical problem also, for we have no doubt that any scheme not based upon chemistry, as well as mechanics, will prove a failure in practice.

Herein is found the probable explanation of the many failures which have attended the attempts to substitute better methods of sewage disposal than its discharge into rivers.

The system of sewage irrigation, that is, the conveyance of sewage in the liquid form to the surface of lands it is desired to enrich, is, in our opinion, so objectionable as not to be tolerated in any civilized community. Such a distribution of undeodorized fæcal matter taints the atmosphere with the most loathsome of odors.

We are not aware that any experiments in sewage irrigation have been attempted in this country, but in England there have been many. A pamphlet, written by James Alexander Manning, and published in London last year, states that the odors arising from two or three hundred acres of the Craigentinny Meadows, near Edinburgh, thus irrigated, were at times almost insupportable for miles around, creating nausea and sickness. The effect upon even the cattle fed upon these meadows was disastrous. Mr. Manning says that a dairyman of Edinburgh lost 92 cows in three years from feeding them upon the grass of sewage-irrigated meadows, and another lost his whole stock in two years from the same cause. He remarks further: "These losses, which would have brought ordinary London dairymen to a state of bankruptcy, did not seem greatly to affect their spirits, for in answer to my expression of sympathy. they coolly observed, 'but sir, they gave an uncommon sight of milk before they died.' I subsequently ascertained that these poor animals were milked while lying groaning in their byres in the last stage of pleuro-pneumonia—a disease which these very men attributed entirely to the unwholesome and poisonous quality of their food. When I remonstrated with them upon their inhumanity, they simply replied, 'we must do as our neighbors.'

"Several letters had, about that period, appeared in the *Scotsman*, the most influential journal of Edinburgh, under the signature of 'A Looker On,' in which the writer alludes to the unwholesome quality of the Edinburgh milk, and instances several cases in which families, arriving from the North had, after a few weeks, been compelled to send their children back again, all of them having been affected with sickness and loss of sppetite, from which they recovered as soon as they were removed from the capital. I brought these facts to the notice of the late Dr. Frederick Penny, Professor of Chemistry, at the Andersonian University, Glasgow, one of the most eminent and distinguished chemists of the period, and he declared that, in his opinion, the rank grass of sewage irrigated land would have a tendency to produce pleuro-pneumonia in cattle, and that the fact of the disease being much more prevalent in all places where the cows were fed upon grass so raised, was a strong confirmation of that theory. At the same time he stated, without the slightest hesitation, his decided objection to the use of the milk from cows, laboring under that disease, which could not be otherwise than injurious to health in general, and while totally unfit for human food, was more particularly dangerous as food for infants."

These facts are sufficient to condemn the practice of sewage irrigation, and it is evident that any system which contemplates the use of sewage as a fertilizer for land must provide for a chemical change in its character. Raw sewage on land is even worse than contaminated water fronts.

It is not our purpose to commend any existing process or plan for the disposal of sewage. Our preference has already been given to the earth system, and, in all the facts elicited throughout the protracted discussion of this most important question, we have yet seen no reason to change it. It has seemed to us that a modification of this system by which the sewage of large towns could be treated in bulk, is possible. The A B C process is, in fact, a modification of it. In this process, alum, blood, and dry pulverized clay are the materials employed to precipitate and absorb the solid matters and salts contained in sewage waters; and if statements made in regard to it are reliable, the results attained are very encouraging.

The writer of the pamphlet alluded to has devised a process by which the excretæ are completely deodorized and disinfected in cess pits or other receptacles devoted to that service; removed in hermetically closed carts, discharged into hermetically closed evaporating chambers and evaporated to dryness; the deleterious gases, the soot and gaseous products of the coal employed in the manufacture, together with the vapors from the liquid portion of the fæcal matter, being all drawn off from the evaporating chamber by means of a powerful exhaust and discharge fan, made to rotate with great velocity by means of a powerful steam engine.

The operations of collecting, treating, and discharging are to be done in hermetically sealed vessels and compartments the emptying and filling of which are accomplished by pneumatic pressure. As thus described, the process is not a mechanical one purely, but it embraces the use of chemicals by which the sewage is not only disinfected and deodorized but also prepared for use as manure, in a perfectly unobjectionable form.

We regret that Mr. Manning does not in his pamphlet give more light upon the chemistry of his process, as we think he has comprehended the true nature of the problem which many have vainly tried to solve. We shall await with interest any further particulars, and shall, if possible, examine such statements of results as may appear, should his process be tried on a scale sufficiently extended to test its merits.

HOW TO BECOME BANKRUPT BY MANUFACTURING.

Not a few, adopting the maxims we are about to promulgate as rules for conducting a manufacturing business, have succeeded in being conspicuously unsuccessful. If any others wish to follow in their illustrious footsteps, let them adhere strictly to the advice we shall give, and we will guarantee the desired result.

Let them branch off into many kinds of manufacturing, or, if manufacturing any particular class of goods, confine themselves as closely as possible to making as many different varieties of wares as the class will permit of. The first is a better and more rapid road to ruin, but the latter will do, provided that:

They so keep their books that they cannot tell how much or little they are making or losing upon each variety of articles they produce, or whether there is either profit or loss on their entire business except when the annual balance sheet is made up. We have known persons who were so foolish as to employ skilled book keepers to keep them informed as to the state of their liabilities and assets. It is rare that such men fail so conspicuously as to acquire public fame. Their example should be avoided by those ambitious to become noted bankrupts.

Let those who wish to fail, also hire as much by the day or week as possible, and eschew the system of "piece work." It is astonishing how much this will grease the wheels of financial disaster, especially if,

They leave everything in charge of a salaried superintendent, not above having his favorites among the employés, who become favorites by seeing that he does not want for a gold watch at Christmas, or cigars to regale himself with during the rest of the year.

Finally, having got things in this way well in train, be sure and take no care of remnants. Let them take care of themselves. To become a bankrupt, one must not respect economy. Economy has stood between many a man and the debtor's prison or the alms house. Therefore, have nothing to do with it. Let scraps rot, and material run to waste. Spend as much time as you can with fast horses, in shooting, fishing, etc., leaving business to the superintendent. When a pinch comes, borrow money, having full faith that it will be easy to pay it when due. So shall you find smooth sailing and fair breezes to waft you swiftly to a port where you will find no lack of congenial society.

COMBUSTIBILITY OF DIAMONDS---VARIOUS EFFECTS PRODUCED BY HIGH TEMPERATURES.

A great many questions are asked, among men of science, as to the degree of combustibility of diamonds. When a diamond is exposed to a very high temperature, does it become black and porous? or does it disappear by volatilization? A few experiments on this subject have been made lately in France.

A celebrated jeweler of Marseilles had been ordered to re-enamel two rings surrounding two fine diamonds of great value. Generally, in such cases, the stones are taken out of the mounting, but he resolved to enamel the gold without removing the stones, and, not having charcoal at hand, he heated the enameling muffle with cannel coal.

The enameling, in coming from the furnace, looked very

© 1871 SCIENTIFIC AMERICAN, INC.

well, but to his great stupefaction the two diamonds had become of a jet black.

Everything was tried to restore them to their former brilliancy and transparency, but without effect; the two diamonds had the appearance of very dark plumbago. Then the stones were taken from their mountings, and sent to London to a lapidary, and the simple contact of the lapidary's wheel was sufficient to render them their luster and former beauty; and the weight of the stones was not even changed.

A chemist then reproduced the experiment by replacing the jeweler's muffle by a platinum tube; and Mr. Laurin, a diamond merchant at Marseilles, put diamonds at his disposal for experimenting. In the platinum tube, the chemist passed common street gas, and brought the temperature to a white heat. The diamonds, having been carefully weighed before experiment, came out from the tube entirely blackened. On the inner surface of the platinum, a deposit of carbon had taken place, which was easily removed. The diamond, on the contrary, had a lamellar appearance, and were crystaline in color, and similar in every point to plumbago or retort coke; and the black deposit on them were very adhesive.

The chemist, Mr. Morren, then heated the stones to a red heat, and the black coating disappeared entirely; the diamonds resuming their former weight and appearance.

If, instead of the street gas or carbureted hydrogen, pure hydrogen be used, sent through the platinum tube in a dry and pure state, the temperature can be brought near to the fusion of platinum without altering the diamonds, and their brilliancy and polish appear to be benefited by this extreme heat. With carbonic acid the diamond loses some of its polish and weight; the carbonic acid is decomposed into oxygen and oxide of carbon. Mr. Morren believed at first that this decomposition was due to the diamond, but he noticed afterwards that it was due to the white heat to which the platinum was brought, acting in a similar way as water in the Grove experiment; at this high temperature the diamond would burn in the presence of the liberated oxygen.

Great pains have been taken to obtain the combustion of the diamond; mirrors, powerful lenses, etc., were used; it is only necessary to burn it in free air, to place the diamond on a thin platinum sheet, and to bring this sheet to a red heat by means of the blower's gas lamp. The diamond takes fire immediately, similarly to a piece of coal, and burns away, and continues to burn if care be taken to continue to heat the platinum sheet which serves as a support.

In all these experiments, the diamond remains perfectly polished, and does not blacken nor split.

If the combustion of the diamond be stopped, the angles of equilateral triangles, are visible, by microscopical examination. They belong to octahedra, placed on each other, and arranged with precision in a way to refract, towards the eye, the light of all the similar triangular surfaces. All diamonds do not present a similar structure; the diamond with a curved face, used for cutting glass, represents, after burning, long prisms or fibers, terminated by equilateral triangles.

THE APPROACHING FAIR OF THE AMERICAN INSTITUTE.

The fortieth annual exhibition of the American Institute will be opened in the Empire Rink, at Third avenue and Sixty-third street, on Monday, Sept. 7th, at 12 M. In addition to the 80,220 square feet of floor, in the Rink as it was last year, at least 13,000 square feet of floor will be added on Third avenue, where a building 48 by 100 feet will be erected. The addition will be chiefly appropriated to the department of fine arts, and will be two and a half stories high. We trust that some attention will be paid to the architectural effects of the new structure, so as to conceal as much as possible the conspicuous ugliness of the Rink. The Board of Management of the Institute have decided to present no medals to exhibitors hereafter, except its great Medal of Honor, which can only be awarded to the discoverer or inventor of a machine, product, or process so important in its application as to supplant any article previously used for the same purpose, or at least to work a favorable revolution in some branch of the useful arts. This decision is in accordance with the precedent established in Paris in 1867. The French Commissioners found great difficulty in reconciling the vast conflicting claims of exhibitors of really meritorious objects; and one of the first steps taken to diminish the complication was to establish the principle that the "grand prize" should only be accorded to the discoverer or inventor of something entirely new. There was, however, an unfortunate want of uniformity in the different groups, as several of them declined to accept the new principle, and proceeded to grant awards according to ancient custom; and much confusion has thus resulted in the interpretation of the prizes gained by exhibitors. For example, the group jury of Group 1, adopted the new principle, and although the class jury desired to make some distinction in the matter of pianos, their request was overruled by the group jury on the ground that pianos were not a new invention. If the class jury had carried their point, we should not have had the amusing controversy which now wages as to who really obtained the highest premium at the Paris Exhibition. We happen to know that the class jury unanimously accorded the highest medal to one manufacturer of pianos, that the above statement is the true explanation of the reason why the firm did not receive it, but were placed on the same footing with one or two others. In other groups, exhibitors were more fortunate, as the rule was not established confining the highest prize to something new. The principle of conferring the Medal of Honor to a new inventor is doubtless the correct one, and will prevent the too frequent and cheapening distribution of prizes. It does not necessarily follow that the grand medal shall be given every year. Great inventions come slowly; and when they are made, a vast hive of smaller industries clusters round them. Bye and bye, another great invention is made; a swarming takes place, carrying off many industries to form a new hive, and the characteristic difference between our age and former times is the frequency in which this swarming now takes place as compared with past eras.

The grand medal can be safely accorded to such inventions as the printing press, the steam engine, the electromagnet, the power loom, the cotton gin, the barometer, the thermometer, the spectroscope, or to such discoveries as the law of gravitation, of the principle of dialysis, of dissociation, of the laws of combustion; and so on through a long list of inventions and discoveries which have brought the sciences and arts to their present high perfection. The Medal of Honor should only be awarded upon the unanimous vote of the Board of Management, and the rules to be observed should be accurately defined before the vote is taken. By undeviatingly adhering to these rules, the Institute may be able to put this medal upon the basis of the highest distinction to be obtained by an inventor in this country. The award to be given to the exhibitor of meritorious articles will be a handsome official copy of the judges' report, made upon the particular merits of the exhibited article, without comparative reference to other articles on exhibition. Each tub will be left "to stand on its own bottom," and invidious distinctions need not be drawn. The chief difficulty to be encountered here is to find competent judges who are willing to serve on the juries. The famous cat which was inveigled by the monkey into snatching the chestnuts from the fire may be taken as a fair prototype of the average juryman who decides upon the value of a man's wares: he is pretty sure to burn his fingers whichever way he decides. It is at best an ungrateful task, and we are not surprised that so many persons hesitate to accept it.

We are aware that the Board of Managers spare no effort to secure the services of competent judges. They prepare their lists early in the year, and issue the summons months before the opening of the Fair; and as one after another declines to serve because "he has read the papers," or "formed an opinion," or "is otherwise engaged," or "is afraid to face the wrath of unsuccessful competitors," they fill up the breach as rapidly as possible, so as to be ready before the grand opening day. It would therefore scarcely be astonishing if some persons who "did not know chalk from cheese" were smuggled on to "the intelligent jury;" though we have yet to learn of any such instance.

The American Institute is really a great public benefaction. It is not a private affair, but established in the interest of the whole people, and ought to be sustained in the most liberal manner; and those who have a knowledge of particular branches of machinery or products ought to be willing, for the common good, to give a little gratuitous service when invited by the Managers to do so. It is desirable to make the judges' report positively valuable; and in many instances, we can conceive of a public benefit to be derived from the publication of a well-digested and ably written report upon some of the newer inventions, processes, or machines likely to be exhibited at the forthcoming Fair of the Institute.

The Board are confident that this exposition of American industry can be made to surpass any that has preceded it; and we trust that in this expectation they will not be disappointed.

THE PATENT AGENCY BUSINESS.

It is doubtless known to most of our readers that Messrs. Munn & Co., publishers of this paper, have for nearly twenty-five years carried on the business of soliciting patents for inventors, in this and foreign countries. Their aim has been to conduct this branch of business in a straight-forward, prompt and efficient manner, always keeping in view the best interest of their clients. How greatly they have succeeded will be understood when we say that, at the present moment, the number of patents obtained through the Scientific American Patent Agency nearly equals, if it does not exceed, that of all the other regular patent agencies in the United States combined.

The most flattering testimonials are constantly received by Messrs. Munn & Co. from their clients in all parts of the country, certifying to the excellent manner in which their business is transacted. We should be happy to publish all of these testimonials did space permit. As it is we must be content with an occasional selection, and here is one from Mr. P. H. Wait, Hydraulic Engineer, manufacturer of the celebrated Hudson River Champion Turbines.

Office of "THE BAKER'S FALLS" IRON MACHINE WORKS,
Sandy Hill, N. Y., August 5th, 1871.

Messrs. MUNN & Co.,

Gentlemen:—Your favor bringing notice that my Patent for Improvement in Turbines and Gate is allowed, is received. Please accept my thanks for the prompt and energetic manner in which you have worked my claims through. This is the fourth patent which you have engineered for me. There has been frankness, ability, and an exertion for my interest manifested in all of your transactions, even beyond my anticipations. I would advise every one having business to transact at the Patent Office to put it into your hands.

Yours truly, P. H. WAIT.

AN English coach painter lately wrote to a brother residing in this country, asking of him, that he would ascertain what method American painters adopt in order to produce the brilliant finish which he had noticed on American coaches sent over to England. The reply was "the Americans build up a firm foundation, free from tackiness, and the finishing coat thereby retains all its brilliancy. At home you use every coating too elastic, from the priming up."

ELECTRICAL ORGAN BLOWERS AND SEWING MACHINE MOTORS.

We recently examined, at the organ establishment of Mason and Hamlin, Broadway, New York, an interesting example of the practical application of electricity as a motor for operating the bellows of organs. It consisted of a diminutive, but powerful rotary electromagnetic engine, which was attached by connecting rod to the bellows' lever of a large parlor organ. A battery of twelve cups was employed. The organist has only to touch a key, or a stop, to set the machine in motion.

This engine was made under Gaum's patents. It consists of a series of fixed magnets, arranged radially upon a common center. A wheel, in the form of an open frame and carrying a series of armatures, revolves around the magnets, the wheel being put in operation by the alternating attractions of the several magnets upon the several armatures. The breaking of the electrical currents is accomplished at the proper moments by a commutator or arm, which is carried by the armature wheel.

The construction of the engine is simple, and its operatio for this purpose apparently quite effective.

We have also seen a smaller size of this invention applied to the driving of sewing machines with much success. The electro-motor is attached to the underside of the sewing machine table, and is so small as not to be noticeable.

To start or stop the sewing machine a small key is touched.

An improved form of battery, the invention of Mr. L. Bastet, is used in connection with these engines, by which the expense of working is greatly reduced. We believe that 25 cents a day, and even less, is the estimated expense of working a sewing machine.

There is a large variety of purposes to which these small electro-motors can be applied with advantage, and we have no doubt that they will come into extensive use. They are made by the Electro Magnetic Engine Co., at the Woodward Co.'s establishment, corner Center and Worth streets, New York.

A NEW BLEACHING PROCESS.

Our readers will remember an article published on page 402, Vol. XXIII. of the SCIENTIFIC AMERICAN, describing a new printer's ink introduced into this country by Leopold Mendelson, of 76 Nassau street, New York. This gentleman has just patented a new bleaching process for discharging the ink alluded to from paper stock, but which has also an extensive application to the bleaching of other fabrics.

The process is also claimed to restore the fiber of paper so that, when remade after bleaching, it is even firmer and stronger than the original stock. If these claims are substantiated upon the introduction of the process, it will prove of great importance to paper manufacturers, and will greatly add to the value of the Kircher's printing ink as well. The invention consists principally in the application of chlorine to the fabric or paper stock to be bleached, the chlorine being produced during the bleaching process by an apparatus connected with the agitator, through which arrangement the process is so simplified that, the inventor claims, the cost of bleaching is very greatly reduced.

Manganese and muriatic acid in equal proportions are used to generate the chlorine gas; this is conducted to a second vessel where it is washed with water. The purified gas is then passed into the third vessel—the agitator—and applied to the substances it is desired to bleach.

The amount of chlorine evolved is regulated according to the quantity needed on any particular occasion, while the rapidity of admission of the purified gas from the washing vessel to the agitator is nicely graduated by a suitable cock.

Overland Telegraph between Asia and America.

In consequence of the high pitch of perfection which has now been attained in the manufacture and working of submarine cables, it may be questioned by some whether it will ever be worth while to carry an Asiatic and American telegraph so far north as Behring's straits, merely for the sake of having a somewhat shorter cable, which was the reason which induced the projectors of the Western Union Extension Company to adopt this route. On this point Mr. Kennan says: "I believe that this is a much more practical route for a line to China than the one recently proposed by Mr. Collins, *vid* the Aleutian Islands, Kamtchatka, and Japan. Labor in Siberia is very cheap, and almost any desired number of men can be engaged at Yakootsk for about forty dollars a year and subsistance. Horses can also be purchased at Yakootsk and Kolyma to the number of five or six hundred, at prices varying from fifteen to twenty-five dollars. Nothing need be brought except wire, insulators, and tools, and a small quantity of provisions for a limited number of foremen. If there were any call for it, I believe that a line could be successfully built from Behring's straits to the Amoor river, in two years, at an expense not exceeding $250,000.

THE last sitting of the *Académie des Sciences Morales*, Paris, was occupied by a discussion raised by M. Egger on the degree of perception and intelligence in children. The question is to ascertain if infants are inferior or superior to ordinary animals in their mental condition. The reasoning of the learned member was grounded more on theoretical grounds than on actual observation of facts. None of the arguments offered were supposed to be conclusive, and the problem is left open for future investigations.

© 1871 SCIENTIFIC AMERICAN, INC.

[Special Correspondence of the Scientific American.]

INTERESTING EXTENSION CASES.---NEW RULES AND REGULATIONS.

Washington, D. C., August 7, 1871.

In the extension case (patent for a double plow), of the administrators of the estate of Arnton Smith (deceased), referred to in a previous letter, Commissioner Leggett has just rendered a decision adverse to the applicant, on the ground that neither the inventor nor the other parties interested have made any diligent effort to manufacture under the patent, or to issue licences or prosecute infringers, and that a continuance of the protection would be decidedly detrimental to the public interest.

The Commissioner has also refused the application for an extension of Levi Bissell's patent for a locomotive truck. The original patent was granted not only with a very limited claim, but after being rejected by the Examiner and the Board. In 1864, the assignees obtained a reissue, in which much that was originally required to be struck out was reinstated, which action of the office is condemned by the present Commissioner as well as by the present Examiner, Mr. E. Spear.

A patent for the same invention was granted to Bissell, in England, three months before the American patent was issued, and the Commissioner considers it very questionable whether, under the law of July 8, 1870, an extension under any circumstances could properly be allowed. The act referred to provides that "no patent shall be declared invalid, by reason of its having been first patented in a foreign country," but "it shall expire at the same time with the foreign patent." The previous Commissioner, Mr. Fisher, in all his rulings subsequent to the passage of this act, held that, though the law did not intend to affect those patents already granted at that time, yet it does prevent the extension of such patents when the original term expires, otherwise it would be a continuation in this country of a monopoly which has terminated abroad. In one of his decisions involving this question, Mr. Fisher says, "whether the section does or does not actually forbid the extension, it so clearly declares that the American patent shall not survive the death of the prior foreign patent, that a decent respect for the declared policy of the legislature would determine an officer, while exercising his discretion, to exercise it in accordance with that policy, and not in opposition to it."

On the other hand, it is urged that the law was intended only to reach the case of the foreign inventor who first patented his invention in his own country, but not to put the American inventor who obtained a patent abroad in a worse position than if he had obtained no patent at all in a foreign country. It is also urged that, if the American patentee had not obtained an English or French patent, the invention would be free in those countries, even during the lifetime of the original patent, and that the fact that it was free there would be no bar to the grant of an extension. The object of Bissell's invention is to prevent the locomotive from running off the track by holding the truck always at right angles to the rail, whether on a curved or straight track, and so preventing it from swinging around in case of meeting with any obstruction. In 1858, fifteen months after the above patent was issued, the applicant received another for substantially the same invention, the only material difference being that the devices were applied to a two wheeled instead of a four wheeled truck, so that practically the first patent is extended for that period under the second.

The application for an extension of the patent to Nicholas and Bly, for an artificial leg, has also been refused, though no opposing testimony was filed. The Examiner, in his report on the case, takes the ground that the invention was not new when patented, and was anticipated in part by an English patent to J. Potts, as far back as the year 1800; and also in the American patents to O. D. Wilcox and B. W. Jewett. The device is a universal joint, connecting the foot and leg pieces, with spring tendons to keep the articulating surfaces in constant co-aptation.

Four extensions have just been granted, namely, to W. M. Ferry, Jr., for an improvement in saw mills; to W. P. Fee, for a cotton seed huller; Alfred Monnier, for manufacture of sulphuric acid; and Charles Winslow, for elastic gore cloth. The leading feature of Ferry's invention consists in causing the saw to cut toward the log instead of toward the slab or board, while cutting cross grain stuff, by giving it a slight obliquity to its usual line of movement parallel to the edge of the log carriage.

Fee's huller has proved a valuable invention, as the machines previously used had more or less of a grinding or crushing action, by which the hulls, kernels and fibers became packed, thereby choking the mill and rendering the process of securing and of expressing the oil very difficult and incomplete. Fee uses, and with great success, a series of cutting edges with deep intervening furrows. By this simple action of cutting the hull, it is readily separated from the kernel, and the grinding pressure is avoided.

Before Monnier's improvement in the manufacture of sulphuric acid, it was common to pulverize and burn iron pyrites and other natural metallic sulphurets with a free supply of oxygen from a draft or blower, the product being sulphurous acid, which contains one proportion of oxygen less than sulphuric acid; and to obtain the needed additional measure of oxygen it was common to continue the burning with nitrate of soda or potash or with nitric acid. This process was attended with a great loss of the sulphur, only about 30 or 40 per cent being secured. To the above processes, Mr. Monnier added that of mixing the pulverized sulphuret, before burning it, with 33 to 75 per cent of caustic soda, or carbonate or sulphate of soda, or sulphate of lime or other salts, by which means nearly all the sulphur is saved.

Of all the acids used in the arts, this is the most important, and on account of its superior attraction for bases it is employed for obtaining almost all the other acids. Though still imported, its manufacture in our own country has become very extended.

The extension of the Winslow patent was strongly contested by the National Rubber Company, of Providence, R. I. The invention is an improvement on what is known as the Tyer and Helm cloth, patented in 1856, and extended in May, 1870; and consists of a rubber or gutta percha fabric, as described in that patent, provided with an elastic binding produced by turning over the edge of one of the pieces composing the fabric so as to cover the edge of the other. This binding strengthens the fabric, and is at the same time elastic in the direction required for making the gores of shoes, etc. An ordinary binding would not answer the purpose, as it would be elastic in the wrong direction. The warp and weft in each piece cross each other diagonally, and the edges are cut and overlapped in lines parallel to the weft, and at acute angles to the warp, and is then cemented to the fabric. The invention is of great value, especially in the manufacture of the well-known Arctic overshoe.

NEW RULES AND REGULATIONS.

The Commissioner has just issued a new set of "Rules and Regulations" to accord with the revised and amended law approved July 8, 1870, and modified March 3, 1871. Some of the more important new features in the office practice are found in sections 11, 42, 44, and 45; and the portions embodying them read as follows:

11. In case the applicant by amendment either enlarges the scope of the claim or claims first filed, or sets up new claims, he will be required to file a supplemental oath relative to the invention as covered by such new or enlarged claim or claims; and such supplemental oath must be upon the same paper which contains the proposed amendment.

42. Every applicant for a patent or the reissue of a patent, any of the claims of which have been twice rejected, may appeal from the decision of the primary Examiner, in such case, to the Board of Examiners-in-Chief, having once paid a fee of ten dollars. For this purpose a petition in writing must be filed, signed by the party or his authorized agent or attorney, praying an appeal and setting forth the reasons upon which the appeal is taken.

This statement of the reasons of appeal should point out distinctly and specifically the supposed errors of the Examiner's action, and should constitute a brief of the argument upon which the applicant will rely in support of his appeal.

Before the appeal is entertained by the Board, this statement will be submitted to the primary Examiner, who will make answer in writing touching all the points involved therein, and who will specially indicate in what particulars, if any, the reasons of appeal fail to represent correctly the issue between the applicant and the Office.

44. All the claims must be passed upon and all preliminary and intermediate questions must be settled before the case is appealed to the Board.

45. Cases which have been deliberately decided by one Commissioner will not be reconsidered by his successor upon the same state of facts. They may, however, be reopened in accordance with the general principles which govern the granting of new trials.

More explicit directions in regard to the preparations of the drawings are given; and hereafter the copies furnished by the office will be executed by the photo-lithographic process.

Meeting of the New York Canal Commission.

The Commission appointed by law to examine inventions, and apportion the reward of one hundred thousand dollars for improved canal boat propulsion, lately held their first meeting at Albany, N. Y.

The Commission consists of Geo. B. McClellan, Horatio Seymour, Erastus S. Prosser, David Dows, George Geddes, Van R. Richmond, Willis S. Nelson, George W. Chapman, William W. Wright and John D. Fay.

Van R. Richmond was elected Chairman, H. A. Petrie, Secretary, David M. Greene, Engineer.

The following resolutions were adopted:

Resolved, That for the purpose of carrying out the intent of the law, this Commission will require, among the tests to be made, that the several competitors shall make not less than three round trips from New York and Buffalo or Oswego, each boat to be loaded with not less than two hundred tuns of cargo each way, the trips to be commenced as soon as any party is ready and all completed in the least practicable time. For the purpose of determining the time consumed by each and all the trips, the clearance must show the day of the month and time of day that the boat passes each Collector's office; certified copies thereof to be furnished the Commission. In order to obtain information in regard to the practical working of the several devices in competition, as soon as practicable, the engineer of the Commission, David M. Greene, of Troy, will inspect the same from time to time, as in his judgment may be necessary, and report the facts obtained to this Commission.

Resolved, That competitors are hereby notified that, for the purpose of carrying out the intent of the law, though it is desirable that the three consecutive round trips from Buffalo or Oswego to New York be made at the earliest time practicable, that the whole of the year 1872 will be allowed to such persons as may desire so much time, and that the awards will not be made until the close of navigation in that year.

The next meeting of the Commission was fixed for August 14th, at the office of the Canal Commissioner, Syracuse, N. Y.

Persons who desire to communicate with the Commission, should address Henry A. Petrie, Secretary. office of the State Engineer, Albany, N. Y. The law in full was published in the SCIENTIFIC AMERICAN of May 6, 1871.

A NEW IDEA IN SAFES.

Mr. S. Morris Lillie, of Elizabeth, N. J., proposes, by means of a new invention recently patented by him, to circumvent burglars in their attacks upon safes. He constructs a safe having within its walls strong receptacles, into which he introduces powerfully compressed or liquified poisonous gases, so that when these chambers or branches extending therefrom are penetrated by the burglars' drill, the gases shall escape and vitiate the air around the safe, and the operations cannot be continued. Branch pipes sealed with suitable fusible plugs are also provided, so that in case of fire, the melting of the plugs will allow the escape of the mephitic gas or gases to extinguish the fire.

The idea of preventing burglars from working in this way is ingenious. The escape of a small quantity of carbonic acid, carbonic oxide, sulphuretted hydrogen, or other gases that might be employed for this purpose, would so vitiate the air of a close room that no one could work in it, and our readers are generally well aware of the power of carbonic acid to extinguish fire. Whether the ingenious fraternity of burglars will be able to match the inventor, by the exercise of equal ingenuity, time will determine.

THE WESTFIELD EXPLOSION.—THE QUESTION ANSWERED.—Mr. Levy F. Smith, of Philadelphia, has cleared up the difficulty about the cause of the boiler explosion on board the *Westfield* ferry boat. His evidence is to the effect that he supplies steamboats with appliances for boilers, that he examined the sheet where the fracture commenced, and he believed it never was first quality iron. That "my opinion is that the explosion was caused by the igniting of gases in the boiler."

Q. "What gases were there?"

A. "Steam is a gas."

Q. "Was there any other gas there besides steam?"

A. "It may have been oxygen."

Examples for the Ladies.

Mrs. A. F. Hall, of Wellsville, N. Y., received 10 years ago a Wheeler & Wilson Machine as a bridal present, the most valuable of her gifts, not excepting a check for $500; it has done all the sewing for her own, her father's and her sister's families, without a cent for repairs, and but two needles broken.

The Pittsburgh (Pa.) *Leader* says: "The firm of George P. Rowell & Co. is the largest and best Advertising Agency in the United States, and we can cheerfully recommend it to the attention of those who desire to advertise their business scientifically and systematically in such a way; that is, to secure the largest amount of publicity for the least expenditure of money."

After Sea Bathing, use Burnett's Kalliston to relieve the disagreeable action of salt water.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

CANNING FRUIT.—In answer to S. H. P. as to the best method of exhausting air from jars, to preserve fruit, etc., I would say the best way is to have the jars hot to begin with, then put in the fruit as hot as possible, and stop the jars hermetically as quickly as possible. I have put up fruit for the last fifteen years with perfect success. At first I used an air-pump, which answered well, but no better than the means above described. The philosophy of it is this. Air, by heating, expands many times its own bulk; consequently, if you take a jar and cover it tightly with the exception of a hole the size of a pin through the cover, and set it in boiling water as air expands twenty times its bulk by heating, it is obvious that 19-20ths of the air passes out through the pin hole in the cover; now drop a little sealing wax or solder over the pin hole and you have but 1-20th of the air in the jar that was in it before heating it. Of course the fruit and syrup, if put into the jar cold, displaces most of the air; but putting it in as hot as it can be, and filling as full as possible, expels the air to all intents and purposes. I have frequently had cans, managed in this way, when made of sheet metal, collapse from outside atmospheric pressure as they cooled off which showed that the exhaustion was complete.—G. W. N., of Ga.

BELTS.—In your paper of July 29, in answer to L. B. G., you say: "There is no rule for locating fixed pulleys on shafts placed in the same plane, but inclined to each other. A belt will not run on pulleys so placed." I have seen one running for years almost at right angles; but there is an upright shaft at the point where lines would cross if drawn from the face of each pulley, carrying a tight and loose pulley, around which the belt runs. Of course, the upright pulleys run in opposite directions. It is very simple where driver and driven pulleys are of equal size, and run in the same plane or level; but it can be done when they are of different diameters, in different planes, or at different relative distances from the floor. If this is what L. B. G. wants, I will give it to him at some future time. And as to belts running in the same parallel, but not in the same plane, or rather where the shafts are so placed, all that is necessary is to reduce the highest end of the driven pulley, so that the belt will draw straight from one shaft to the other, more or less, according as one end of the shaft is more or less raised above the level of the driver.—J. E. S., of Me.

CUTTING GIMLET POINTED SCREWS.—The screw blank is clasped by a pair of revolving jaws which hold it by the head. Next a cutter is swung round on a pivoted arm and shaves the point to the proper taper. As soon as the point is shaved this cutter swings back out of the way, and the cutter for the thread begins its work. The thread cutter commences nearest the head of the screw and passes toward the point as the screw revolves, taking a light chip. Then it is released and flies back towards the head, and starts with another chip. This is repeated until the screw is cut to the proper depth. For cutting the longer screws, a grooved rest is held against the side opposite the cutter to keep the screw from springing. I have given a general description without details. No dies are used.—G. A. B., of R. I.

FROST PROOF BUILDING.—W. S. H. inquires how to build a frost proof room above ground. I believe the best way to do it would be to build double walls and roof, the farther apart the better, and fill the space with saw dust or similar material. The outside walls and roof, I would make of rough boards, and cover with tin as near air tight as possible. This will stop the circulation of the air, and rats. Dig the earth out of the inside as deep as convenient, or sink a well hole in the center. Floor over level with the ground, leaving a little space between the edge of the floor and the wall for the warmth to rise through. The filling between the walls should go some distance below the surface; or if the ground be wet, cover a few feet out from the wall with straw or something that will keep out frost.—F. A., of Iowa.

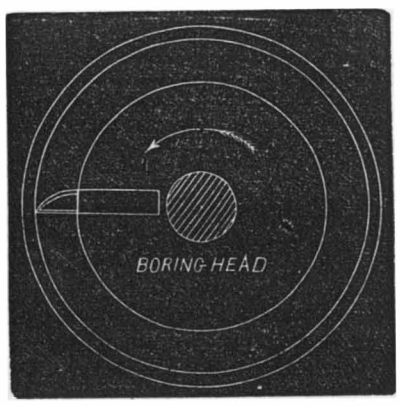
© 1871 SCIENTIFIC AMERICAN, INC.

SALT IN SOAP MAKING.—In answer to C. F. M. in regard to use of salt in making soap, I cannot give him the formula of Mr. Alex. T. Macrae, but I will give him my own if he wishes to try it. Let him use good lye from hickory ashes, or "concentrated lye," and the usual amount of soap grease, and make his soft soap in the ordinary way, boiling it well. Try it as it progresses, and when it gets to a proper jelly consistency, upon cooling, add common salt, and try it after the addition, until upon cooling it gets quite firm and hard; then pour the whole kettle full out in some receptacle so as to allow the soap to be about four or five inches in depth. Let it cool, and then cut in blocks and put in a *dry* place, and he will find it improve by age. A little practice will be all he requires to get the proper proportion of salt to be added.—R. S. S. H., of Md.

MARINE GLUE.—In response to J. H. P.'s request in regard to marine glue, (in the issue of 22d inst.), I must refer him for a more accurate formula for preparing it to Tomlinson's *Encyclopœdia of the Arts and Sciences*, article on glue and shellac. I have not the book at hand, and it is years since I have seen it, but I have made marine glue by its formula. The ether used must be perfectly free from alcohol, as that fluid acts as a precipitant upon india rubber. Heat, however, must be applied in hastening a solution, the best means for so doing being the sand bath. [In my article on glues, you made me say "take the scales" of certain fish; I wrote, "take the skins."]—F. L. J., of Ark.

FROST PROOF BUILDING.—My father's plan is to put oak sills level with the ground, so that no air can get under them. He then puts up the frame in the ordinary way, weather boards it, and sheets it on the inside with tongued and grooved plank, and then fills the space between with sawdust or tanbark packed tight. Before putting the sawdust or tanbark in, it is best to put six or eight inches of cinders from the blacksmith shop, to keep the rats from cutting through. The floor above should be tight to exclude the wind. My father has kept apples, potatoes, eggs, etc., without freezing, in a house of this kind for 13 or 14 years.—J. V. J., of Ontario.

RELATIVE POWER IN BORING AND TURNING.—G. S. R. does not give hight of point above the shank of his tool, nor does he say whether the cylinder remains firm. However, I do not think that it does or can take more power to bore a 16 inch cylinder than to turn a 16 inch pulley, provided every thing be right in both cases. In outside turning, the shank of tool stands at an obtuse angle with the work, above the tool, giving somewhat near an end thrust, in direction of the shank, and is therefore not liable to spring into the work. Inside turning or boring the tool stands at an acute angle with the work, ahead, and is very liable to spring in if not of proper shape, or if not set right; when, if the belt does not slip, something must give. If he will use a side tool, as in diagram, from ½ inch



to 1 inch ahead of center, clamped firm, I cannot see why he should have any more trouble. As to speed, if the length of cylinder is same as face o pulley, and inside of cylinder be free from sand, as pulley, I see no necessity for any variation.—B. P. G., of Mass.

RELATIVE POWER IN BORING AND TURNING.—Answer to G. S. R., query 1, July 22.—The reason that more power is required to bore a cylinder than to turn a pulley is because of the difference of angles at which the chips are to the cut. The curve in the cylinder tends to thicken and support the chip in advance of the cut, while that of the pulley reduces and weakens it.—E. S. W.—[We have received many letters on this subject, but as they are to the same effect as E. S. W.'s, it is unnecessary to print them. The opinion expressed is undoubtedly the correct one. Moreover, the difference in the required power increases as the diameter of the cylinder diminishes, as lessening the curve of the surface facilitates external and retards internal cutting.—EDS.]

SMOOTHING STEEL WITHOUT FILING.—I have done a great deal of such work by first turning and then grinding, revolving my axle on centers, and grindstone on bearings. Of course the face of the stone needs to be less than one half the width of the length of the bearing; and the same time both axle and grindstone are rotated, the shafts or axle or grindstone must be reciprocated properly. If properly done, the metal is much more perfect than if filed.—H. J. H., of N. Y.

PUTTING UP FRUIT IN GLASS.—S. H. P. will find the following entirely satisfactory. Simply place a common table spoon in the jar before pouring in the boiling hot fruit; pour until the jar is full, then remove the spoon and fill the vacancy caused by its removal. Fasten the jar at once, as usual, and the fruit is safe. I put up thirteen dozen in this way last year, and not a single jar broke, nor was any of the fruit spoiled. L. C.

FINISHING WALNUT.—H. W. M.—For filling walnut wood, there are many compounds in use, several of them under patents; that which discolors the wood the least and at the same time produces a fine finish, is the most simple of them all, being nothing but fine rye flour mixed with boiled oil, japan and turpentine, ground fine in a paint mill, and slightly colored with burnt umber.—C. T., of Vt.

A. L., of Mass.—We believe that the theory of cushioning by exhaust closure is sound both in theory and practice; and also that the use of independent cams and eccentrics for this purpose is the better way when it can be done conveniently. At the same time it may be advisable on some engines to give some lead to the induction valves in conjunction with early exhaust closure.

WASHING ETHER.—Turn the ether and water into a glass funnel, while you hold a finger to the end to prevent anything from running out. The ether rises to the top, the water and residue fall to the bottom. Take away your finger from the funnel and let the water out; then save your ether. It is almost as simple as saving washed oil.—H. J. H. of N. Y.

OILING BELTS.—A good way to oil belts is to pour the oil on to the inside of the belt as it runs, and let the pulleys work it in. It may be put on freely if the belt be running idle, but if at work it will take but a small quantity at a time without slipping. Keep the leather just oily enough to make it pliable.—O. A. B., of N. Y.

COATING IRON MOLDS.—G. J. C. asks what to coat iron molds with to produce good smooth castings. If he will smoke his molds well before pouring his metal, I think he will find no trouble. I am no molder, but have seen it done with the desired effect.—C. H. C., of N. Y.

QUARTER TWIST BELTS.—In answer to J. E. D.'s query about quarter twist belt holes, (July 29), you make me say:—Moreover, J. E. D. will find it economical, etc. It should read: moreover, J. E. D. will not find it economical, etc.—F. H. C., of N. Y.

BELTS.—Answer to J. E. G., query 10, July 22.—If two shafts in the same plane, but not parallel, are belted together, the belt will run towards the ends that are nearest together.—E. S. W.

LINING IRON VESSELS.—J. H. P.—Tin is the best material for lining iron pots and kettles. They can be easily retinned when required. The process laid down by McKensie is effectual and very simple. His book will be found in almost every library.—C. T., of Vt.

CHEAP HORSE POWER.—E. G. A.—The best of "cheap horse powers can be made by erecting an upright shaft with sweep, and a large drum attached to it. Gear up with smaller drums to any speed required —C. T., of Vt.

SIZING FOR GILDING.—M.—The best sizing for gilding on glass is made as follows: Put a piece of isinglass as large as an old fashioned cent into a teacup; fill half full with boiling water. When well mixed, and before cold, fill nearly full with spirits of wine.—C. T., of Vt.

C. M. R., of N. H.—Were we about to transmit power from a prime motor through a distance of 650 feet we should use a telodynamic cable, or wire rope belt, unless it were requisite to take off power along the line of transmission, in which case we should use a shaft.

E. M. F., of Ohio—The maximum velocity of rivers, creeks, etc., is in a vertical plane where the water is deepest and at a point somewhat below the surface, the distance below depending upon the depth of the stream, incline and character of the channel, bottom, etc.

M. H., of Mass.—The so called sweating on the outside of vessels containing liquids is caused by the condensation of atmospheric moisture thereon. Outside moisture will not strike through air tight metallic cans.

J. N., of N. B.—The valve of your engine, is evidently from your description, not properly set. You should obtain the advice of a competent engineer and have him indicate your engine and adjust it properly.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

QUERIES—T. H.—V. W. K.—R. P. K.—and G. A.

RELATIVE POWER IN BORING AND TURNING—F. A., J. W. B., and W.

CANAL NAVIGATION—B. W. H., and C. T.

KEEPING FLIES FROM HORSES—J. G. T.

SPEEDY AND QUICK TRANSPORTATION—H. C. J.

NEW BOAT TO RUN UPON LAND AND WATER—J. M.

RUNNING OF BELTS—W. G. B.

PRACTICAL NAVIGATION OF THE AIR— ———.

CHINESE PUZZLE—F. A.

PAINE'S MOTOR—C. T.

STEAM PLOWING MACHINE—E. C. H.

SPIRITUAL PHENOMENA—R. H.

THE IMMORTAL INVENTOR OF THE TELEGRAPH ON STORM AND FLOOD SIGNALS—A. W.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

d'Heureuse's Patent Air Treatment in the quick, cheap, and perfect manufacture of wine, cider, spirits, sugar, oils, etc. Rights for sale. For particulars, apply to R. d'Heureuse, P. O. Box 6,844 New York.

The Baxter Steam Engine Co., 18 Park Place, New York, have the most economical engine. Sizes 2 to 10 H.P. Send for Circular.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

For best Lubricating Oil, Chard & Howe, 134 Maiden Lane, N.Y.

The Eccentric Elliptic Geared Power Presses are the best in the world. For Circulars, address Ivens & Brooke, Trenton, N.J.

To Cotton Pressers, Storage Men, and Freighters.—35-horse Engine and Boiler, with two Hydraulic Cotton Presses, each capable of pressing 35 bales an hour. Machinery first class. Price extremely low. Wm. D. Andrews & Bro., 414 Water st. New York.

L. & J. W. Feuchtwanger, Chemists, 55 Cedar st., New York, manufacturers of Silicates of Soda and Potash, and Soluble Glass.

Send your address to Howard & Co., No. 865 Broadway, New York, and by return mail you will receive their Descriptive Price List of Waltham Watches. All prices reduced since February 1st.

Dealers in mill machinery, please send address to S. H. Soule, Binghamton, N. Y.

Quinn's Patent Ferrule makes good all leaky boiler tubes. Address P. Quinn, South Newmarket, N. H.

Self-testing Steam Gauge.—The accuracy of this gauge can be tested without removing it from its connection with the boiler. Send circular. E. H. Ashcroft, Boston, Mass.

Ashcroft's Low Water Detector. Thousands in use. Price, $15. Can be applied for less than $1. Send for Circular. E. H. Ashcroft, Boston, Mass.

See advertisement of new Machinist's tool on last page.

Sell your patents for the Pacific coast through Wiester & Co., 17 New Montgomery street, San Francisco, Cal.

Lord's Boiler Powder is only 15 cts. per pound by the bbl., and guaranteed to remove any scale that forms in steam boilers. Our Circular, with terms and references, will satisfy all. Geo. W. Lord, 107 W. Girard ave., Philadelphia, Pa.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro, 414 Water st., N. Y.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

For Sale—A Patent on Steam Mangle. Address P. Rundquist, 954 Sixth Avenue, New York City.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Diamond Carbon, of all sizes and shapes furnished for drilling rock, sawing and turning stone, conglomerates, or other hard substances also Glazier's Diamonds, by John Dickinson, 64 Nassau st., New York.

Glynn's Anti-Incrustator for Steam Boilers—The only reliable preventive. No foaming, and does not attack metals of boilers. Price 25 cents per lb. C. D. Fredricks, 587 Broadway, New York.

To Ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's Manufacturing News of the United States. Terms $4 00 a year.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct

The Greenleaf Grate Bar saves fuel, and lasts much longer than the ordinary bar. Address Greenleaf Machine Works, Indianapolis, Ind.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth st., Brooklyn, manufacture Presses and Dies. Send for Catalogu

Makers of 4 in. light Cast Iron Pipe, address E. Whiteley, 61 Charlestown Street, Boston.

Any person wishing to engage in the manufacturing business in the West, can secure the real estate and buildings, on the most favorable terms, in a city of 6,000 inhabitants, who will extend aid and encouragement to good men. Address K. G. Cooper, Jefferson City, Mo.

Improved Mode of Graining Wood with Metallic Plates, patent July 5th, 1870, by J. J. Callow, Cleveland, O. Sample plate sent for $3.

See Gen. D. C. Buell's advertisement of the Airdrie Iron works and Coal lands.

Wanted—To purchase an established business, or an interest therein; Manufacturing or Chemical preferred. Address F. C. Beach 260 Broadway, corner Warren, basement, New York.

Wanted—A travelling or peddling agency which will pay. Address "Bombyx," care C. H. Jones & Co. 114 Fulton Street, N. Y.

For cars and track of the Portable Railroad, send your orders to Val. Hilburn, Easton, Pa.

Omnibuses, in good condition, for sale low, by I. C. Moore, 215 Arch Street, Philadelphia.

Wanted—A Machine for cutting oval openings in thick cardboard. C. Faser, 822 Arch Street, Philadelphia, Pa.

Wanted—Proposals for furnishing, either new or second hand, 1,000 feet 1 to 1¼ in. gas pipe. Address Trevor & Co., Lockport, N. Y.

The best Compression and Self-closing Faucets are manufactured by H. Moore, 41 Center Street, New York.

Lead Pipe, Sheet and Bar Lead. For a good article, address Bailey, Farrell & Co., Pittsburgh, Pa.

Superior Belting—The best Philadelphia Oak Tanned Leather Belting is manufactured by C. W. Arny, 301 Cherry Street, Philadelphia.

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—SETTING BOILERS.—Will it be safe to place a forty inch two flue boiler, twenty-four feet long, alongside of two forty-eight inch tubular boilers, fourteen feet long, all to be heated together in the usual way, and connected as usual by steam and mud drums?—W. E. H.

2.—TORTOISE SHELL.—What is the best method of preparing tortoise shell for pressing in molds?—C. L.

3.—DRESSING SKINS WITH THE HAIR ON.—Will some one please tell me the best mode of dressing hides with the hair or fur on?—J. S. P.

4.—COLORING COPAL VARNISH.—Can any of your readers tell me how to color copal varnish, so that when applied to wood which has not been stained, it will present the color of black walnut or other dark wood?—Mc. H.

5.—VESSEL FOR COOKING TOMATOES.—What is the best kind of metal to use in making a vessel to manufacture tomato catsup? We have used tin, but find the action of the acid of the tomato soon uses it up. —I.

6.—CEMENT FOR PAPER.—Do any of your readers know of any glue, cement, or mucilage with which paper, cloth, etc., can be pasted together, so that hot oils cannot percolate through the joints?—A. I. M.

7.—BATTERY.—Nemo talks to the point on the battery question. I should like to hear from him as regards the following: Would not a carbon plate, instead of the copper, in the bichromate solution, give the same quantity and more intensity? Is the bichromate solution identical with the battery fluid sold commercially as electropoin? Does the bichromate solution give off fumes, so as to make it undesirable in a dwelling house?—NEUTRAL.

8.—GALVANIZING WIRE SPRINGS.—Can any of your readers give me a recipe for galvanizing or zinc coating wire springs, without heating them so as to impair the temper?—O. A. B.

9.—DRIP PIPE OF STEAM HEATER.—Will some of your readers explain why it is that in fitting up a building with steam for heating purposes, the drip or return pipe connections are always made below the water line in the boiler? Is this necessary? If it is, would they be kind enough to say a word or two on the subject?—A. S.

10.—SHADING BRONZE.—Will some of your readers tell me the best and easiest way of shading bronze?—G. N. R.

11.—GRINDING ORES.—Can any one tell me which is the best kind of mill to use for grinding iron ores; the Chilian or other?—J. A. T.

12.—BOTTLING CIDER.—Will some of your many correspondents give me a recipe for bottling and preserving cider during the winter? I have drunk cider put up North which tasted like champagne.—F. L. J.

13.—LEAKAGE OF PAILS.—Can any of your readers tell me why a common wooden pail which is perfectly tight when containing water should leak or soak through when containing whitewash or lime and water —J. B.

14.—CONE PULLEYS.—I wish to belt from a cone pulley of three steps, sixteen, fifteen, and fourteen inches in diameter, to another the smallest pulley of which is one inch in diameter. What size must I turn the two larger pulleys on the small cone, so that the belt shall run with equal tension on all the pulleys?—A. W. G.

15.—PARIS GREEN ON POTATOES.—Will the use of Paris green on potato plants poison the tubers, so as to poison those that eat them? It is held by many, and by some that should know, that such is the case. can see no difference in the quality or taste of them.—C. E. McR.

16.—POROUS CELL FOR BATTERY.—Can I, in a galvanic battery, use for a porous cell a sack made of soft leather? The battery is put up in the following manner: In a two gallon stone jar is fitted a sheet of copper; the jar is then filled with a diluted solution of sulphuric and nitric acid, one pound of the former and one half ounce of the latter for two gallons of water. For a porous cell I intend to take a bag or sack made of soft leather, to be filled with a concentrated solution of common salt, in which a zinc bar is to be immersed.—A. R.

© 1871 SCIENTIFIC AMERICAN, INC.

17.—DEFECTIVE CASTINGS.—In the ornamental leaves of house columns I find the following defects: On the outside they are soft, while on the inside they are so hard that the drill will not touch them. The castings are not annealed. No. 1 foundery iron was charged in the cupola; the mold was made in green sand. The defect was noticed in drilling. I cannot account for the peculiar character of such castings, though I have noticed pigs of the blast furnace to be of the same description. I would be obliged if some practical founderyman would give the cause in the columns of your paper.—C. F. L.

18.—REVARNISHING.—Will some of your numerous readers give me directions for revarnishing furniture without removing the old coat of varnish?—H. G. W.

19.—SAND AND EMERY BELTS.—I wish directions for preparing sand or emery belts for finishing woodwork. I require something of the kind in the manufacture of my paper files (for which you procured me a patent), and do not know how to prepare it.—B. F. N.

20.—RESTORING GLUE.—I wish to ask, through "Queries," how to restore glue which has soured from some cause unknown, and will not dry?—E. S. C. B.

21.—DRAWING COMPASSES.—I have some fine steel pointed drawing compasses, the points of which have been blunted or turned. Can some of your readers inform me how to renew those points, still preserving the graduating angle?—J. E. B.

22.—GRAVEL WALKS.—What substance sprinkled on a gravel walk will kill vegetation? I have tried salt, but that does not have the required effect.—F. C.

23.—TABLE CUTLERY.—D. B., of N. Y., answers my inquiry about cutlery, that "my knives were made to sell, not to cut;" now in this connection all I can say is to reiterate what was in my original communication, namely, that I have purchased of the best and most reliable importers of the article in question in Baltimore, and taken "Rodgers'," "Wostenholm's," and "Butcher's" branded carvers, and they do wear for a short time, but the material seems to get entirely worthless. I profess to know something in regard to sharpening, and the use of the "steel," but the edge turns off at once, and I was anxious to know whether the use of scalding water, in which they are put by servants, had any effect upon the temper; and if so, whether the knives could be re-tempered?—R. S. S. H.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

JAR MOVEMENT FOR ROCK DRILLS.—Hugo Sontag, of Osnabruck, Germany. The drill shank is made in the form of a cylindrical rod of suitable length. Its upper end is swiveled in a sleeve having projecting wings, and each wing having projecting ears. The shank is fitted into a tubular shell, vertically slotted to admit the wings of the sleeve. The tube or shell is suspended from its upper end, which is rigidly fixed to a rod suspended from a rope swiveled in a link connected with raising and lowering apparatus. On this rod is a vertically adjustable plate, whose motion up and down is limited by shoulders or pins. This is connected with the rope or chain, by which the plate and parts attached to it are lifted. From this plate are suspended two rods, which extend down the shell into projecting enlargements of the same. Each rod has two projecting ears near the upper end of the slot. Whenever the drill is let down and touches bottom, the ears strike the upper portion of the slots of the shell, and are moved on inclined edges into enlargements of the slots, and rest on projections of the shell. The drill being dropped into the rock, tripping mechanism unlocks the tubular shell, and the latter acts as a hammer upon the bit socket. The drill is then withdrawn, and the movement repeated; but if the bit becomes stuck and resists withdrawal, the tripping mechanism unlocks the shell which is drawn up, creating a jar that loosens the drill in its seat.

COMBINED SAD IRON AND RUFFLER.—William Banzett, Williamsburg, N. Y.—This invention relates to the combination with an ordinary sad iron of a pair of fluted rollers mounted in vertical standards, placed at the front and rear ends of the iron, said standards being also connected at their upper ends with the handle of the sad iron, the object of thus combining the iron and rollers being to furnish a ready means of fluting ruffles and other like articles after they have been ironed.

MUSIC LEAF TURNER.—Arthur W. Bush, and Marshall McComb, of St. Cloud, Mich. This is a combination and arrangement of various devices whereby an instrument is produced that may be easily attached to a piano, organ, or other key board instrument, and which will turn the pages of music as they are required, either by the use of the hand or foot.

HORSE HAY FORK.—Jacob Huy, of Bakerstown, Pa. This is a combination of pointed tube rod, springs, and shouldered and pivoted prongs, loop, pivoted lock, trip arrows and catch, by which a very compact harpoon fork is secured, and one which we judge will be very effective in use.

LAMP CHIMNEY.—Edward David Ashe, of Brompton, England. A new way of forming the upper section of the chimney of conducting and radiating material, which shall rapidly absorb the heat evolved from combustion, and convey it to an adjacent vessel of water, is employed. The metal section is made conical, and is suited for the reception of small sheet metal vessels having vertical central conical pipes through them, which may be put on for heating water or other substances. The lower part of the chimney is a short glass section, which is fitted to the lamp top in the ordinary or any approved manner, and in any approved form. It is provided with a cylindrical or slightly conical part at the upper end, to which is fitted the tin or other sheet metal section, so as to hold with sufficient power by the frictional contact. Immediately above the top of the glass section it is provided with the air holes for admitting air to the flame at or above the top, by which the combustion is made more perfect, smoking prevented, and the flame improved in brilliancy.

GRAIN SPOUT.—John O. Frost, of Candor, N. Y.—This is a new and useful improvement in spouts for delivering grain and similar commodities into bags; and consists in a sleeve made to slide on the spout by means of an eccentric or other analogous or equivalent device, the construction and arrangement being as hereinafter more fully described. When the sleeve is thrown down by the eccentric, the bag is fasted between the collar and the end of the sleeve. When the eccentric is turned and the sleeve is thrown up, room is left for adjusting the bag over the collar. By this improvement no hooks are required, and, consequently, there is no tearing of the bags, or of the clothes or fingers of the miller. The inventor does not confine himself to this particular arrangement; the sleeve may be operated on the spout by means of a cam and without a hand wheel.

EARTH BORING AUGER.—This invention relates to a new and useful improvement in augers for boring wells, whereby it is claimed much valuable time is saved. It consists in forming the auger of a longitudinal section of a hollow cylinder flattened on its back so as to admit air, and provided with a cutting bit and circular lip, which receives and supports the column of earth when the auger is withdrawn. The bit works downward as the auger is revolved, and the earth which is thus undermined is left stationary with the auger, and when the pod or auger is full it is raised, and swinging, as it does, from a derrick, it is turned in a horizontal position with the open side down, when the earth drops by its own gravity. Water is used during the process of boring with this auger, which greatly diminishes the friction. Air is constantly admitted to the auger by means of a flattened space on the back, which prevents a vacuum being formed to retard or obstruct its withdrawal. With this auger the earth is, it is claimed, readily bored to the depth of a hundred feet or more. The auger is attached to the end of a wooden rod, to which the power is directly applied. There is a band around the semi-cylinder near the top, two inches under, more or less, the object of which is to support the load in the auger (tenacious clay, for instance), and prevent its discharge before the proper time. William Wheeten Jilz, of Hamilton, Mo., is the inventor of this implement.

APPARATUS FOR TRANSMITTING MOTION.—Edward H. Bancroft, of Syracuse, N. Y. This invention relates to improvements in apparatus for transmitting motion from the horizontal shaft of a wind wheel revolving around a vertical axis, or other powers having like action; and it consists in a connection of two cranks on the said shaft by connecting rods and cross heads, or slides with a pair of reciprocating rods, so that the cross heads or slides, and their supports which are mounted on the horizontally revolving frame by which the wind wheel shaft is supported, may have the said horizontal motion while transmitting the reciprocating motion to the reciprocating rods, which impart motion to a revolving shaft by two other connecting rods and cranks, both pairs of the cranks being set perpendicular to each other for passing the dead centers. The invention also comprises an arrangement of one of the said reciprocating rods within the other, and the shaft driven by them above the lower ends, to which the connecting rods are attached, and passing through a slot in each of said rods in a manner to economize space, and simplify the cost of the apparatus.

WASHING MACHINE.—Isaac H. Adams, of Montana, Iowa.—This invention relates to a new and improved washing machine, in which the essential feature is an arrangement of the rubbing boards, which is placed in the bottom of the tub, and commonly made stationary, with a joint at or about the center, and connecting the lower part with the levers for working the vibrating board, so that after the latter has been raised well off the clothes the said jointed part will be raised so as to turn and shift the clothes to facilitate the presenting all sides to the rubbing boards.

SELF-LUBRICATING JOURNAL BOX.—James Duff, Peoria, Ill.—This invention relates to a journal box placed within an oil box, and provided with a wick occupying a longitudinal groove in the side of the journal box, at the top of the same, and passing at one or more points through orifices in the journal box into the oil box, so as to take oil from the latter by capillary attraction, and deliver it at the side of the shaft in the journal box, from which it runs back into the oil box through spaces left between the ends of the latter and of the journal box, and also through spaces at the sides.

SHAFT COUPLING.—Edward G. Shortt, Carthage, N. Y.—This invention is an improvement on that for which letters patent of the United States No. 95,277, were granted to applicants on Sept. 28th, 1869, and consists in forming a transverse slot at the middle of the wedges to enable them to spring and close down upon shafts varying in size in different parts; and also in transverse grooves made in the backs of the wedges to hold tallow, and thereby prevent the wedges from rusting or adhering to the inside of the sleeve or tube.

TOY.—This is a toy constructed of spiral grooves on conical upright standards, in combination with grooved inclined planes, etc., down which marbles are rolled to a receiving block, the object being to see how many balls can be kept moving down the grooves by taking them one by one from the receiving block, and placing them in a cap at the top of the toy. Samuel Patterson, of Newark, N. J., is the inventor.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING AUGUST 8, 1871.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent, (seventeen years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (three and a half years)	$10
On an application for Design (seven years)	$15
On an application for Design (fourteen years)	$30

For Copy of Claim of any Patent issued within 30 years $1

A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from $1

upward, but usually at the price above-named.

The full Specification of any patent issued since Nov. 20, 1866 *at which time the Patent Office commenced printing them* ..... $1·25

Official Copies of Drawings of any patent issued since 1836, we can supply at a reasonable cost, the price depending upon the amount of labor involved and the number of views.

Full information, as to price of drawings, in each case, may be had by addressing

MUNN & CO.,

Patent Solicitors. 37 Park Row, New York.

117,716.—SEWING MACHINE.—J. S. Alter, Leavenworth, Kan.
117,717.—FOG HORN.—J. R. Anderson, Brooklyn, N. Y.
117,718.—FEEDER.—J. P. Arey, Georgetown, Colorado.
117,719.—HOOK HOLDER.—L. Arnold, Belchertown, Mass.
117,720.—BOILER.—I. Atyco, North Fairfield, Ohio.
117,721.—BUILDING.—F. M. Bain, Delaware, Ohio.
117,722.—SOAP.—G. Baker, I. Bullock, Lima, Pa.
117,723.—LADLE.—R. D. Baker, Syracuse, N. Y.
117,724.—BEDSTEAD.—T. B. Baldwin, Marshall, Texas.
117,725.—SAD IRON, ETC.—W. Banzett, Williamsburgh, N. Y.
117,726.—HARVESTER.—J. J. and D. N. Barnhill, Vincennes, Ind.
117,727.—RANGE SETTING.—A. F. Barry, New York city.
117,728.—SHOULDER BRACE.—A. W. Beaman, Boston, Mass.
117,729.—RAFTER HOOK.—J. N. Bebout, Oberlin, Ohio.
117,730.—AXLE.—J. W. and A. W. Beer, Rural Valley, Pa.
117,731.—SPRING VENT.—E. J. Bennett, Port Huron, Mich.
117,732.—DENTAL DRILL.—G. V. Black, Jacksonville, Ill.
117,733.—SHAFT COUPLING.—G. V. Black, Jacksonville, Ill.
117,734.—PLOW.—A. J. Borland, Charlestown, Iowa.
117,735.—CARPET STRETCHER.—W. Brown, New York city.
117,736.—GRAIN THRASHER.—R. Bryan, Penn Yann, N. Y.
117,737.—IRONING TABLE.—F. A. Byram, Germantown, Pa.
117,738.—STILL.—R. P. Buckland, Jr., G. A. Gessner, Fremont, O.
117,739.—CAR.—N. W., C. W. Camp, Saratoga, N. Y., N. H. Camp, Wilkesbarre, Pa.
117,740.—WASHING MACH.—W. Clack, Prairie du Chien, Wit.
117,741.—CLEANER.—C. B. Clark, Armada, Mich.
117,742.—TRACE BUCKLE.—I. Clark, Dryden, Mich.
117,743.—INKSTAND.—S. D. Clark, Minneapolis, Minn.
117,744.—TWEER.—T. S. Clark, Chicago, Ill.
117,745.—WHEEL PIT.—J. Collins, Crawfordsville, Ind.
117,746.—CUTTER.—J. W. Cornell, Lawn Ridge, Ill.
117,747.—CUT OFF.—W. B. Cross, Sacramento, Cal.
117,748.—PENCIL.—H. T. Cushman, North Bennington, Vt.
117,749.—FIRE SHIELD.—A. Dean, Ann Arbor, Mich.
117,750.—SIPHON.—E. de Lagillardaie, L'Orient, France.
117,751.—ANIMAL POKE.—N. Denny, Saranac, Mich.
117,752.—DOG.—G. E. Dowling, S. F. Cone, Montague, Mich.
117,753.—JOURNAL BOX.—I. Dripps, Altoona, Pa.
117,754.—ICE PICK.—W. T. Eames, New York city.
117,755.—HAND CARD.—G. F. Ells, Douglas, N. Y.
117,756.—COAL SHOVEL.—J. H. Farmer, Detroit, Mich.
117,757.—KINDLER.—J. E. Finley, G. H. Hurd, B. F. Tatem, Memphis, Tenn.
117,758.—CLUTCH GEARING.—L. S. Fithian, Brooklyn, N. Y.
117,759.—ROAD STEAMER.—G. W. Fitts, Oberlin, Ohio.
117,760.—TIRE.—G. W. Fitts, Oberlin, Ohio.
117,761.—DRAWING BOARD.—J. B. Franklin, New York city
117,762.—DAMPER.—B. French, Rochester, N. Y.
117,763.—CANDLE HOLDER.—J. Fritsch, Carlstadt, N. J.
117,764.—LOCK.—C. T. Gibson, Baltimore, Md.
117,765.—CASTER.—J. Gibson, Jr., Albany, N. Y.
117,766.—SAUCER.—J. Gibson, Jr., Albany, N. Y.
117,767.—SAP SPOUT.—W. S. Gilmore, Chester, Ohio.
117,768.—LET OFF.—F. W. Graichen, Olneyville, R. I.
117,769.—SAW FRAME.—J. H. Graham, Brooklyn, N. Y.
117,770.—SOLDERING.—J. Gulding, Keyport, N. J.
117,771.—TELEGRAPH.—I. Hall, New York city.
117,772.—REMOVING SAND.—J. Halliday, New Orleans, La.
117,773.—FIRE ESCAPE.—J. C. Hancock, Charlestown, E. P. Richardson, Somerville, Mass.
117,774.—SHEARS.—C. F. Harlow, Boston, Mass.
117,775.—LOUNGE.—V. O. Hart, J. Benjamin, Naples, N. Y.
117,776.—BLOWER.—S. H. Hartman, Allegheny, Pa.
117,777.—BOOT STRETCHER.—J. Hoffman, Belvidere, N. J.
117,778.—HOIST.—J. Hoffmann, Tewksbury, N. J.
117,779.—LET OFF.—W. H. Howard, Philadelphia, Pa.
117,780.—GAME.—C. N. Hoyt, Providence, R. I.
117,781.—WATER GATE.—W. P. Hubbard, Farmland, Ind.
117,782.—WATCH.—S. Jaccard, J. J. Jaques, St. Croix, Switzerland.
117,783.—BELLOWS.—A. F. Jones, New York city.
117,784.—AUGER.—S. Katz, Bossardsville, Pa.
117,785.—PRESS.—F. Klinck, Philadelphia, Pa.
117,786.—PLUG CUTTER.—D. S. Kniffen, West Camden, N. Y
117,787.—DEFECATING, ETC.—M. Landry, Iberville, La.
117,788.—TREMOLO.—J. R. Lomas, New Haven, Conn.
117,789.—ELEVATOR.—G. B. Lowe, Jamesville, N. Y.
117,790.—SIEVE.—R. J. Mann, Burlington, Iowa.
117,791.—DIGITORIUM.—M. Marks, London, England.
117,792.—WASHING MACHINE.—T. A. Massie, Plattsburgh, Mo.
117,793.—CLINCHER.—D. Mater, Jr., Bellmore, Ind.
117,794.—COTTON PRESS.—A. McGowen, Houston, Texas.
117,795.—ENVELOPE.—C. E. McMahan, Elizabeth, N. J.
117,796.—BLEACHING.—L. Mendelson, New York city.
117,797.—SEWING MACHINE.—N. Meyers, Buffalo, N. Y.
117,798.—JOIST HOOK.—J. S. Miller, Terre Haute, Ind.
117,799.—SOCKET.—S. Mitchell, Lima, N. Y.
117,800.—BURIAL CASKET.—J. O. Moore, Albany, N. Y.
117,801.—PLOW.—S. D., D. A., J. B. Morrison, Fort Madison, Iowa.
117,802.—PAVEMENT.—D. H. Mulford, Saratoga, N. Y.
117,803.—CULTIVATOR.—A. H. Myers, Hermon, Ill.
117,804.—ICE ELEVATOR.—J. J. Neuman, Middletown, Conn.
117,805.—CARBONIC ACID.—J. D. O'Donnell, Washington, D.C.
117,806.—TRUNK LOCK.—J. H. Oliver, Baltimore, Md.
117,807.—FOUNTAIN.—J. S. Orndorff, Virginia City, Nev.
117,808.—BALANCE VALVE.—J. V. Pangburn, Galesburg, Ill.
117,809.—CRADLE.—C. O. Parker, Liverpool, Nova Scotia.
117,810.—CHAIR, ETC.—D. O. Parker, Liverpool, Nova Scotia.
117,811.—SHOE.—C. W. Peeler, Chicago, Ill., N. C. Johnson, Springfield, Ill.
117,812.—THRASHING MACHINE.—W. H. Pratt, Chicago, Ill.
117,813.—PLOW.—R. M. Primmer, Vinton, Iowa.
117,814.—FURNACE.—H. Randall, Quincy, Ill.
117,815.—BEE HIVE.—O. P. Reeve, C. C. Parker, Central city, Mo.
117,816.—CORNER POST.—J. Roberts, Worcester, Mass.
117,817.—LIFE BOAT.—R. I. Robeson, Oskaloosa, Iowa.
117,818.—CARD ENVELOPE.—C. Rowland, Washington, D. C.
117,819.—SPRING.—C. W. Saladee, St. Catharine's, Canada.
117,820.—HEATING DRUM.—C. W. Servoss, Chicago, Ill.
117,821.—CHURN.—J. Shaver, Lawrence, Ill.
117,822.—PADDLE WHEEL.—N. P. Sheldon, San Francisco, Cal.
117,823.—SHAFT COUPLING.—E. G. Shortt, Carthage, N. Y.
117,824.—DISINTEGRATER.—C. G. C. Simpson, Montreal, Can.
117,825.—AIR ENGINE.—A. M. Smith, Chicago, Ill.
117,826.—DIE MOLD.—I. Smith, New York city.
117,827.—SAW SHARPENER.—Z. Sperry, Midland, Mich.
117,828.—TURNING LOGS.—E. H. Stearns, Erie, Pa.
117,829.—DRAFT.—J. S. Tibbets, Brazil, Ind.
117,830.—BED BOTTOM.—C. H. Triphagen, Pewamo, Mich.
117,831.—CORNER SOCKET.—J. W. Truby, Chicago, Ill.
117,832.—HAND STAMP.—S. S. Turner, Westborough, C. and G. M. Stevens, Boston, Mass.
117,833.—STOVE.—H. B. Van Benthuysen, Lockhaven, Pa.
117,834.—POT COVER.—S. Van Horn, Chicopee, Mass.
117,835.—SEED PLANTER.—T. G. S. Vaniz, Canton, Miss.
117,836.—RECTIFYING SPIRITS.—W. H. Ware, Phila., Pa.
117,837.—SHUTTLE.—C. H. Waters, Groton, W. Orr, Jr., Clinton, Mass.
117,838.—DIE.—R. N. Watrous, Elmira, N. Y.
117,839.—PEG CUTTER.—W. M. Watt, Como, Miss.
117,840.—HOIST.—A. Weide, Chicago, Ill.
117,841.—AIR BRAKE.—G. Westinghouse, Jr., Pittsburgh, Pa.
117,842.—BRICK MACHINE.—W. G. White, Bedford, Ohio.
117,843.—FIRE ARM.—A. E. Whitmore, Ilion, N. Y.
117,844.—BROOM.—A. Willis, Chicago, Ill.
117,845.—OILING JOURNALS.—W. G. Winne, Albany, N. Y.
117,846.—WASHING MACHINE.—G. L. Witsil, Phila., Pa.
117,847.—CLOTHES DRYER.—M. H. Wood, Carlisle, Ohio.
117,848.—DITCHING MACHINE.—S. S. Wood, Brooklyn, N. Y.
117,849.—HUB.—J. V. Woolsey. Sandusky, Ohio.
117,850.—CUTTER HEAD.—J. V. Woolsey, Sandusky, Ohio.
117,851.—PENCIL.—C. E. Abbott, Malden, R. S. Merrill, Hyde Park, Mass.
117,852.—FIBER.—W. Adamson, F. A. Simonin, Phila., Pa.
117,853.—VALVE.—A. F. Allen, Providence, R. I.
117,854.—OIL CAN.—M. Andrew, Melbourne, Victoria.
117,855.—ROOFING.—W. S. Belt, Cincinnati, Ohio.
117,856.—BOOT SOLES.—L. R. Blake, Fort Wayne, Ind.
117,857.—TAP.—C. T. Bonsall, T. Bergner, Phila, Pa.
117,858.—TRAVELING BAG.—H. Braunhold, New York city.
117,859.—ORGAN.—R. Burdett, B. O. Church, Chicago, Ill.
117,860.—BED SPRING.—E. L. Bushnell, Poughkeepsie, N. Y
117,861.—FOG ALARM.—S. G. Cabell, Quincy, Ill.
117,862.—HARVESTER.—J. A. Cauldwell, Watkins, N. Y.
117,863.—FIRE SCREEN.—A. Chesnutwood, Davidsville, Pa.
117,864.—MOWING MACHINE.—L. S. Clark, Bethel, Conn.
117,865.—CROQUET ARCH.—F. M. Clarke, Washington, D. C
117,866.—FAUCET.—W. Cleveland, Orange, N. J.
117,867.—HAT TIP.—J. L. Coles, Newark, N. J.
117,868.—JOURNAL.—S. P. and H. B. Cook, San Francisco, Cal.
117,869.—CANAL BOAT.—M. N. Cummiskey, Paterson, N. J.
117,870.—MEDICAL COMPOUND.—W. Curless, Truckee, Cal.
117,871.—CALL BELL.—H. A. Dierkes, New York city.
117,872.—SAFETY VALVE.—J. B. Edson, Brooklyn, N. Y.
117,873.—CONDENSER.—H. W. Faucet, Titusville, T. McGowan Meredith, Pa.
117,874.—WAGON SEAT.—J. H. Fellows, Alba, Pa.
117,875.—BRACKET.—L. W. Fifield, Worcester, Mass.
117,876.—SHOE.—F. D. Ford, New Bedford, Mass., E. D. McIntosh, Washington, D. C.
117,877.—LEATHER.—J. P. Friend, Peabody, Mass.
117,878.—HUB.—J. H. Gaines, Durhamville, Tenn.
117,879.—COFFEE MILL, ETC.—J. Garfield, Ayer, Mass.
117,880.—DIP PIPE.—W. E. Grenelle, New York city.
117,881.—LOCK NUT.—R. W. Hamilton, New York city.
117,882.—BUCKLE.—G. Havell, Newark, N. J.
117,883.—HOG RING.—D. P. Heflebower, Champaign, Ohio.

© 1871 SCIENTIFIC AMERICAN, INC.

117,884.—PRESERVING FRUIT.—F.C.Hooton, West Chester, Pa.
117,885.—DRAWER.—I. A. Howe, Boston, Mass.
117,886.—KNITTING MACHINE.—J. M. Howe, Rochester, N. Y.
117,887.—STAVE.—A. J. Howell, J. Murphey, Spruce Hill, Pa.
117,888.—SHEARS.—H. H. Ingalsbe, South Hartford, G. A. Prescott, Sandy Hill, N. Y.
117,889.—MILK COMPOUND.—V. A. Jagielski, London, Eng.
117,890.—STILL.—C. B. Jarvis, J. W. Goff, Cincinnati, Ohio.
117,891.—FIRE EXTINGUISHER.—S. B. Johnson, Phila. P.
117,892.—EXTRACTOR.—T. E. Johnson, Indianapolis, Ind.
117,893.—JACK.—P. Keane, Cohoes, N. Y.
117,894.—HANGER—T. Kent, J. S. Barker, Waukegan, Ill.
117,895.—FAUCET.—W. H. Laubach, Phila. Pa.
117,896.—DRILL.—J. Lemman, Cincinnati, Ohio.
117,897.—RUBBER SHOE.—J. Letson, New Brunswick, N. J.
117,898.—CIDER MILL.—H. Lightner, Neff's Mills, Pa.
117,899.—SAFE.—L. Lillie, Elizabeth, N. J.
117,900.—FIRE EXTINGUISHER.—S. M. Lillie, Elizabeth, N. J.
117,901.—GATE.—E. Livingston, Manchester, Ill.
117,902.—CARRIAGE WHEEL.—J.H.Loughbridge, Key W., Fla.
117,903.—GOVERNOR.—J. D. Lynde, Phila., Pa.
117,904.—DENTAL INSTRUMENT.—C. H. Mack, Portland, Oreg.
117,905.—GLUE.—J. J. Manning, Rockport, Mass.
117,906.—FIRE-ARM.—J. M. Mason, Washington, D. C.
117,907.—GAGE COCK.—P. McGrath, Plattsburgh, N. Y.
117,908.—COCK.—J. Metier Meharg, Montreal, Canada.
117,909.—COUPLING.—G. H. Merriam, Portland, Me.
117,910.—PLANTER.—C.T. Merry, M. A. Dunton, Norwalk, O.
117,911.—HARVESTER.—J. Miller, Swan, Ind.
117,912.—LOCK.—S. Miller, Gratis, Ohio.
117,913.—POTATO DIGGER.—H J. Moore, Topeka, Kan.
117,914.—BEE HIVE.—S. C. Moore, Pattonsburgh, Mo.
117.915.—CHAIR.— J.Morrison, Indianapolis, Ind.
117,916.—BUTTON, ETC.—C. A. Newton, Providence, R. I.
117,917.—HAY RAKE.—G. Notman, Deerfield, Ohio.
117,918.—STOPPER.—F. A. Ostrander, Troy, N. Y.
117,919.—LEVER PRESS.—J. Outland, Barnesville, Ohio.
117,920.—STAVE.—L. R. Palmer, Belfast, Me.
117,921.—LEATHER.—J. C. Pamerlee, Bean Blossom, Ind.
117,922.—ANIMAL POWER.—W. Patterson, Oneonta, N. Y.
117,923.—TRACE BUCKLE.—D. K. Peacock, Little Valley, N.Y.
117,924.—GRATER.—C. R. Peirce, Phila., Pa.
117,925.—GAS PUMP.—W. H. Pollard, Seneca Falls, N. Y.
117,926.—FLAX PULLER.—B. M. Reeves, Franklin, Pa.
117,927.—STUFFING BOX.—P.W. Richards, Boston, Mass.
117,928.—STUFFING BOX, ETC.—P.W. Richards, Boston, Mass.
117,929.—STEERING.—N. Richardson, Gloucester, Mass.
117,930.—COMPOUND. J. D. Richmond, Jr., N. Liberty, Ky.
117,931.—KNITTING MACHINE.—S. H. Roper, Roxbury, Mass.
117,932.—DIE.—C. E. Russ, Boston, Mass.
117,933.—RAIL.—R. S. Sanborn, Rockford, Ill.
117,934.—SPINNING RING.—J. H. Sawyer, Lowell, Mass.
117,935.—SATCHEL, ETC.—F. C. Schmidt, Newark, N. J.
117,936.—SAW MILL.—G.Selden, Erie, Pa.
117,937.—THILL COUPLING.—S. Slack, Lebanon Center, N.H.
117,938.—FLOUR BOLT.—J. C. Smith, Zanesfield, Ohio.
117,939.—PACKING.—S. Stroock, New York city.
117,940.—WASHING MACHINE.—A.T. Sullivan, San José, Cal.
117,941.—VENTILATOR.—O.W. Swift, New Haven, Conn.
117,942.—BEVERAGE.—A. S. Taylor, San Francisco, Cal.
117,943.—MOP HEAD.—L. W. Taylor, Upper Falls, Vt.
117,944.—SAW.—P. Thompson, Pittsburgh, Pa.
117,945.—ICE CREEPER.—E. M. Turner, Pittsburgh, Pa.
117,946.—PAVING, ETC.—A. B. Vandemark, Jersey City, N. J.
117,947.—TWEER.—P. L.Weimer, Lebanon, Pa.
117,948.—HOIST.—J. Wheelock, Worcester Mass.
117,949.—STEEL TOOL, ETC.—D. Wihl, Brooklyn, N. Y.
117,950.—STEEL TOOL, ETC.—D. Wihl, Brooklyn, N. Y.
117,951.—SPLITTING MACHINE.—W. L. Williams N. Y. city.
117,952.—SPLITTING WOOD.—W. L. Williams, N. Y. city.
117,953.—DIE.—J. T. Wilson, Pittsburgh, Pa.
117,954.—DIE.—J. T. Wilson, Pittsburgh, Pa.
117,955.—HEEL.—C. Lambert, Quincy, Mass.
117,956.—BARREL PITCHER. A.D.Witzleben, Washington, D.C.

REISSUES.

4,501.—FIRE PLATE.—E. Boileau, St. Louis, Mo.—Patent No. 92,253, dated July 6, 1869.
4,502.—JOURNAL BOX.— J. Duff, Peoria, Ill.—Patent No. 90,937, June 8, 1869.
4,503.—Division A.—CLOTHES FRAME.—J. E. Earle, New Haven, Conn.—Patent No. 36,994, dated November 25, 1862.
4,504.—Division B.—CLOTHES FRAME.—J. E. Earle, New Haven, Conn.—Patent No. 36,994, dated November 25, 1862.
4,505.—CLOTHES RACK.—V. M. Heath, Morristown, Vt.—Patent No. 94,598, dated September 7, 1869.
4,506.—IRON SPOON.—G. I. Mix, Yalesville, Conn.—Patent No. 18,513, dated October 27, 1857.
4,507.—IRON AND STEEL.—A. H. Siegfried, South Bend, Ind.—Patent No. 113,583, deated April 11, 1871.
4,508.—EXTRACTING FAT.—C. F. A. Simonin, Phila., Pa., and E. W. Coffin, Glendale, N. J.—Patent No. 102,166, dated April 19, 1870; reissue No. 4,067, dated July 12, 1870.
4,509.—Division A.—LOOM HARNESS.—J. Sladdin, Lawrence, Mass.—Patent No. 80,774, dated August 4, 1868.
4,510.—Division B.—LOOM HARNESS.—J. Sladdin, Lawrence, Mass.—Patent No. 80,774, dated August 4, 1868.
4,511.—GRATE BAR.—J. R. Smith, Salem, Mass.—Patent No. 70,638, dated November 5, 1867.

DESIGNS.

5,164 to 5,174.—CARPETS.—R. R. Campbell, Lowell, Mass.
5,175.—CARPET PATTERN.—A. Cowell, Kidderminster, Eng.
5,176.—MOLDING.—J. H. Ferreira, Newark, N. J.
5,177 & 5,178.—STAIR RODS.—W. B. Gould, New York city.
5,179 to 5,182.—OIL CLOTHS.—Henry Kagy, Philadelphia, Pa.
5,183.—SHARPENER.—C. Kennedy, Philadelphia, Pa.
5,184.—CARPET PATTERN.—W. Kerr, Phila., Pa.
5,185.—DRAWER PULL.—J. Kintz, West Meriden, Conn.
5,186.—TILE.—B. Kreischer, New York city.
5,187.—CARPET PATTERN.—C. S. Lilley, Lowell, Mass.
5,188 & 5,189.—CARPET.—J. Neil, Clinton, Mass.
5,190.—CAKE DISH.—W. Parkin, Taunton, Mass.
5,191.—HARNESS SADDLE.—L. Rommeiks, Newark, N. J.
5,192.—DRAWER PULL.—J. B. Sargent, New Haven, Conn.
5,193.—CARRIAGE BODY.—R. M. Stivers, New York city.
5,194.—DENTIST'S TRAY.—E. T. Starr, Phila., P.
5,195.—CALL BELL.—H. C. Wilcox, West Meriden, Conn.
5,196.—TEA BELL.—H. C. Wilcox, West Meriden, Conn.

TRADE MARKS.

416.—MEDICINE.—P. Davis & Son, Providence, R. I.
417.—MEDICINE.—J. N. Harris & Co., Cincinnati, Ohio.
418.—SHIRTING.—B. B. & R. Knight, Providence, R. I.
419.—JEWELRY, ETC.—S. Landsberg, New York City.
420.—FABRICS.— San Francisco Pioneer Woolen Factory, San Francisco, Cal.
421.—MEDICINE.—Tilden & Co., New Lebanon, N. Y.

EXTENSIONS.

BOBBINS, I.HAYDEN, of Boston, Mass. Letters Patent No.17,929, dated August 4, 1857.
SULPHURIC ACID. A. MONNIER, of Philadelphia, Pa.—Letters Patent No. 17,976, dated August 11, 1857; reissue No. 502, dated October 6, 1857; reissue No. 603, dated September 21, 1858.

Inventions Patented in England by Americans.

July 18 o July 24, 1871, inclusive.
[Compiled from the Commissioners of Patents' Journal.

AXLE.—W. A. Lewis, Chicago, Ill.
BOOT HEEL.—R. C. Lambert, Quincy, Mass.
CHAIR.—W. Palmer, New York city.
CUTTING ENVELOPES, ETC.—H. A. Clark, Boston, Mass.
HASP.—W. H. Tison, Savannah, Ga.
LOOM.—J. Kuttner, New York city.
STEAM PLOW.—J. Lochhead, C. A. Mathieu, San Francisco, Cal.
STOP MOTION.—P. Wilson, J. Hunter, Manchester, N. H.
WHEEL, JOURNAL, AND LUBRICATOR.—W. A. Lewis, Chicago, Ill.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000 Belgium, 5,000,000; Austria, 36,000,000; Prussia 40,000,000; and Russia, 70,000,000. Patents may be secured by American zens in all of these countries. Now is the time, while business is dull at e, to take advantage of these immense foreign fields. Mechanical im vements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars, with full information on foreign patents. furnished free.

Receipts—When money is paid at the office for subscriptions, a receipt for it will be given; but when subscribers remit their money by mail, they may consider the arrival of the first paper a *bona-fide* acknowledgment of their funds

City Subscribers.—The SCIENTIFIC AMERICAN will be delivered in every part of the city at $3·50 a year. Single copies for sale at the News-stands n this city, Brooklyn, Jersey City, and Williamsburgh, and by most of the News Dealers in the United States.

Subscribers—Who wish to have their volumes bound, can send them to this office. The charge for binding is $1·50 per volume. The amount should be remitted in advance, and the volumes will be sent as soon as they are bound.

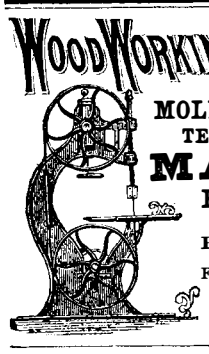
Advertisements.

The value of the SCIENTIFIC AMERICAN *as an advertising medium cannot be over-estimated. Its circulation is ten times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading-rooms of the world. We invite the attention of those who wish to make their business known to the annexed rates. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. If it is worth 25 cents per line to advertise in a paper of three thousand circulation, it is worth $2.50 ver line to advertise in one of thirty thousand.*

RATES OF ADVERTISING.

Back Page - - - - 1·00 a line,
Inside Page - - - 75 cents a line
for each insertion.

Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.



WOOD WORKING MACHINERY
MOLDING, MORTISING,
TENONING & SHAPING
MACHINES;
BAND SAWS,
SCROLL SAWS,
PLANING & MATCHING MACHINES, &c.,
For RAILROAD, CAR, and AGRICULTURAL SHOPS.
☞ Superior to any in use.
J. A. FAY & CO.,
CINCINNATI, OHIO.

THE AIRDRIE IRON WORKS FOR SALE. They consist of an iron plated hot blast furnace and machinery of the capacity of twenty tuns a day, and can be started in sixty days. 6,000 tuns of roasted blackband ore and some coke are on the ground, and the raw materials are near at hand. The works, then new, have not been in operation since before the war. They stand on the banks of Green River, which has slack water navigation. The property includes some 17,000 acres of iron and coal lands, and is situated in the midst of railroads in course of rapid construction, and partly just completed, which will afford direct access to various important points. The Elizabethtown and Paducah Road, just finished to Louisville, crosses Green River three miles below the works. The ores are believed to be excellent for making steel. The works, with the privilege of the raw materials to feed them, will be given for thirty-four years, free of rent or royalty, to responsible parties, who will furnish the capital to cary them on, for an equal share of the profits. Valuable beds of coal on the same lands will also be let on liberal terms. Some of them are now being worked, and have an established reputation in the market. Call upon or address General D. C. BUELL, at Airdrie. Post Office, Paradise, Muhlenburg county, Ky.

PRINTING TELEGRAPH.—Private Lines. The best, simple, rapid one wire printer. Right for Northern and Western States for sale. Address DAVID FLANERY, Lock Box 289, New Orleans.

We make only one style, and have but one price for our Pianos, which are all made from thoroughly seasoned and kiln-dried materials, and have seven octaves—rosewood case—carved legs and lyre—large square grand overstrung scale—front round corners—serpentine bottom—iron plate—French action—and are all warranted five years. We have no agents, and allow no commissions or discounts to any one. This explains how we can sell a good Piano for $290, which is about the price Piano dealers pay to manufacturers for instruments similar to ours. Piano dealers are allowed by all manufacturers, except ourselves, to add 100 per cent., and upward, profit to all sales. This the public can prove by investigation to be strictly true. Piano dealers, teachers, professors, and everybody else, are excluded from any and every possibility of a single cent of commission on our Pianos. If you wish a Piano sent for trial, you must make the matter of reference and payment unquestionable; and if the instrument is in any respect inferior to any Piano made in the known world at any price, you may send it back to us at the end of ten days' trial, instead of paying for it. If you order a Piano sent, we have one request to make; and that is, that the trial shall be made by parties who are not interested in other Pianos. Please send for our Circulars containing full particulars and references to bankers, merchants, and families, in thirty-five States and Territories, who are using our Pianos. Address or apply to the
UNITED STATES PIANO CO., 645 Broadway, N. Y.

RUN NO RISK.

USE Shaw & Justice's Mercurial Steam Gauge. Absolutely reliable at all times. All sizes for sale by PHILIP S. JUSTICE, 42 Cliff St., N. Y.; 14 North 5th, Philadelphia.

METHFESSEL INSTITUTE.

SELECT SCHOOL for boys and girls, in separate departments, with first rate modern arrangements for boarders. Specialities: Modern languages and exact sciences. A new course commences on the first Monday of Sept. References exchanged. A. G. METHFESSEL, P. O. Box 51, Stapleton, Staten Island, N.Y.

FOR SALE—1 Steam Hammer, 36 in. Cylinder, 7 Tun Ram. 1 Anvil and 2 Dies. 1 Tubular Boiler, 100 HP. Cast and Wrought Iron Mountings for 4 Furnaces. 2 Safety Valves (Morris & Parker). 1 Steam Stop Valve (Ludlow). 1 Butterfly Valve. 1 Steam and 1 Water Gauge. 1 Steam Pump. 1 Platform Scale. 1 Oiling Machine. 1 Iron Roller, Truck, and Roller Table. 1 Pair Shears, 1 Ax and 1 Pump. 3 Wrought Iron Escape Pipes (Gals). 4 Sections and 1 Elbow 6 in. Steam Pipe. 1 Lot Wrought Steam Pipe and Corks. 1 Lot Tools. 1 Lot 12 in. Dressed Lumber.
For further information, apply to
A. HAAS, 105 E. 11th Street, New York city.

WANTED—By the La. Fertilizer Manuf'g Company, Hydraulic Presses, Patent Mixers and Driers. Engines, Hoisting Apparatus, of the latest and most approved inventions, for the manufacture of Fertilizers. Send Circulars and Price Lists to the undersigned. J. M. LOEWENSTEIN, Superintendent La. Fertilizer Manufacturing Company, Lock Box 806, New Orleans, La.

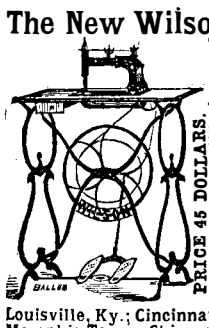
ELECTRO-MAGNETS—Galvanic Batteries of all kinds—Telegraph Instruments, Wire, and every device in the Electrical line, manufactured by C. WILLIAMS, Jr., 109 Court Street, Boston, Mass.
(ESTABLISHED IN 1856.)

FOR SALE—A Band Saw, also Planer and Matcher, Surfacer, Molder, Tenoning, Mortis, Variety, Scroll Saws, &c. GEORGE HARVEY, 23 Ferry Street, New York.

FOR SALE CHEAP—Shop, Engine, and Machinery for manufacturing Cabinet ware and Chairs. A good opening for the business. For particulars, address DAVID COON, Ypsilanti, Mich.

FOR SALE—Our twenty-five horse power Beam Steam Engine, in good order—only sold for want of use. For particulars, apply to HENRY SEYMOUR & CO., 29 Rose Street, N. Y.

The New Wilson Under-Feed.



THE BEST & CHEAPEST FIRST CLASS SHUTTLE SEWING MACHINE IN THE WORLD.
Warranted for five years, and the warranty indemnified by a capital of half a million of dollars.
AGENTS WANTED in unoccupied territory. For particulars address Wilson Sewing Machine Co. Cleveland, O.; St. Louis, Mo.; Providence, R. I.; Philadelphia, Pa.; Boston, Mass.; Pittsburg, Pa. Louisville, Ky.; Cincinnati, O.; Indianapolis, Ind.; Memphis, Tenn.; Chicago, Ill.; Milwaukee, Wis.; Toledo, O.; Albany, N.Y.; St. Paul, Minn.; Richmond, Va.; Montgomery, Ala.; New Orleans, La.; Galveston & Houston, Tex.; San Francisco, Cal.; or
No. 707 BROADWAY, NEW YORK

MACHINISTS

AND WORKERS IN METALS will find the most complete assortment of Small Tools and Materials, also STUBS' Files, Tools and Steel, Lathes, Emery Wheels, &c., in the country, at A. J. WILKINSON & Co., 2 Washington St., Boston. Catalogues and price-lists sent free.

To Electro-Platers.

BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with books of instruction, manufactured and sold by THOMAS HALL, Manufacturing Electrician, 19 Bromfield street, Boston, Mass. Illustrated catalogue sent free on application.

PORTABLE STEAM ENGINES, COMBINING the maximum of efficiency, durability and economy, with the minimum of weight and price. They are widely and favorably known, more than **900** being in use. All warranted satisfactory or no sale. Descriptive circulars sent on application. Address
J. C. HOADLEY & CO., Lawrence, Mass.
46. Cortlandt st. New York.

SHINGLE AND BARREL MACHINERY.—Improved Law's Patent Shingle and Heading Machine, simplest and best in use. Also, Shingle Heading and Stave Jointers, Stave Equalizers, Heading Planers, Turners, etc. Address TREVOR & Co., Lockport, N.Y.

LATHE CHUCKS—HORTON'S PATENT from 4 to 36 inches. Also for car wheels. Address E. HORTON & SON, Windsor Locks Conn.

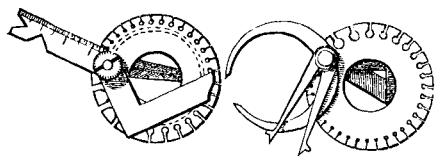
MASON'S PAT'T FRICTION CLUTCHES are manufactured by Volney W. Mason & Co., Providence, R. I. Agents, R. BROOKS & CO., 123 Ave. D, New York; TAPLIN, RICE & CO., Akron, Ohio.

ALLCOTT'S LATHES, for Broom, Hoe, and Rake Handles, for sale by
L. W. POND, 98 Liberty st. New York.

$10 A DAY, with Stencil Tools. Samples free. Address A. E. GRAHAM, Springfield, Vt.

ANY party having a bevel Gear pattern about 5 to 1, pitch 1¾ to 1¾, please send description and price casting to I. M. ALBERTSON, New London, Ct.

The Wilkinson Combination Tool



CAN be carried in the vest pocket, and combines seven full-sized tools, indispensable to mechanics. Price, $3.00. H. P. GREGORY General Agent, Plattsburgh, N. Y.

Canadian Inventors,

Under the new Patent Law, can obtain patents on the same terms as citizens.
For full particulars address
MUNN & CO.,
37 Park Row, New York.

Whitney's Neats Foot Harness Soap.

(STEAM REFINED.)
It Oils, Blacks, Polishes, and Soaps at the same time. For sale by Harness Makers Grocers, and Druggists everywhere.
Manufactured by G. F. WHITNEY & CO. Lexington, Mass.

The Stevens Institute of Technology

A SCHOOL OF MECHANICAL ENGINEERING, in Hoboken, N. J. Founded by the late EDWIN A. STEVENS.

FACULTY.

President—HENRY MORTON, Ph. D.
Prof. of Physics—A. M. MAYER, Ph. D., late of Lehigh University.
Prof. of Engineering—R. H. THURSTON, C. E., late of United States Naval Academy, Annapolis.
Prof. of Mathematics—Lieut. Col. A. S. HASCALL, U. S. A., late of U. S. Military Academy, West Point.
Prof. of Mechanical Drawing—C. W. MCCORD, A. M.
Prof. of Chemistry—A. R. LEEDS, A. M.
Prof. of Modern Languages—C. F. KRÆH, A. M.
Prof. of Belles Lettres—Rev. EDWARD WALL.

This institution will open its first session on the 20th of September, 1871. Examinations for admission will be held during the previous week.
This institution was endowed by Mr. Stevens with a sum amounting in all, up to the present time, to about $750,000, and has been supplied with a building, laboratories for physics as well as chemistry, cabinets of apparatus and models, workshops and other appliances, which are without a parallel in the country. Fees for tuition to residents of the State of New Jersey, $75; to others, $150. This distinction is made in accordance with the special provision of Mr. Stevens' will.
For announcements and further information, address,
HENRY MORTON, President, Hoboken, N. J.

THE WOODWARD STEAM-PUMP MANUFACTURING COMPANY, Manufacturers of the Woodward Pat. Improved Safety Steam Pump and Fire Engine, Steam, Water, and Gas Fittings of all kinds. Also Dealers in Wrought-iron Pipe, Boiler Tubes, etc. Hotels Churches, Factories, & Public Buildings heated by Steam, Low Pressure. Woodward Building, 76 and 78 Center st., cor. of Worth st. (formerly of 77 Beekman st., N. Y. All parties are hereby cautioned against infringing the Pat. Right of the above Pump. G. M. WOODWARD, Pres't.

RUMPFF & LUTZ,

IMPORTERS and Manufacturers of Aniline Colors and Dyestuffs, Colors for Paperhangers and Stainers. Reliable recipes for Dyeing and Printing on Silk, Wool, and Cotton. All new improvements in the art of Dyeing, and new Colors are transmitted to us by our friends in Europe, as soon as they appear.
42 Beaver street, New York.

Patents on Designs.

Citizens and aliens can now secure design patents for three and a half, seven, and fourteen years. The law on this subject is very liberal. Foreigners, designers, and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent other makers from selling similar goods in this market.
These patents cover all novelties of form or configuration of articles of manufacture.
For further information address
MUNN & CO.,
No. 37 Park Row, New York.

Trade-Mark Patents.

MUNN & CO. desire to call the attention of manufacturers and business men generally, to the importance of the law of patents, as applied to trade-marks for business purposes.
Any person, firm, or corporation, domiciled in the United States, or in any foreign country affording similar privileges to citizens of the United States, can obtain the right to the exclusive use, for THIRTY YEARS, of any TRADE-MARK, consisting of any new figure, or design, or any new word, or new combination of words, letters, or figures upon their manufactures.
This protection extends to trade-marks already in use for anyl ength of time, or about to be adopted.
Full information on this important subject can be obtained by addressing
MUNN & CO.
37 Park Row, New York.

© 1871 SCIENTIFIC AMERICAN, INC.

BAIRD'S BOOKS FOR PRACTICAL MEN.

MY new revised and enlarged Catalogue of PRACTICAL AND SCIENTIFIC BOOKS, complete to July 1, 1871, 94 pages, 8vo., will be sent, free of postage, to any one who will favor me with his address.

HENRY CAREY BAIRD,

INDUSTRIAL PUBLISHER,

406 Walnut st., Philadelphia, Pa.

Fresh Industrial Literature

JUST PUBLISHED.

A Treatise on the Manufacture and Distillation of Alcoholic Liquors: Translated from the French of MM. DUPLAIS, Aîné et Jeune, by M. MCKENNIE, M.D. Illustrated by fourteen folding plates and several wood engravings. 743 pages. 8vo.....$10 00

☞ *This volume is offered to the American public as the fullest, best, and most reliable on the subjects treated ever printed in the English language.*

A General Treatise on the Manufacture of Vinegar: Theoretical and Practical. Comprising the various Methods by which the Slow and the Quick Processes, with Alcohol, Wine, Grain, Malt, Cider, Molasses, and Beets; as well as the Fabrications of Wood Vinegar, etc., etc. By Prof. H. DUSSAUCE. In one volume. 8vo.....$5 00

RECENTLY PUBLISHED.

Sign Writing and Glass Embossing: A Complete Practical Illustrated Manual of the Art. By JAMES CALLINGHAM. To which are added numerous alphabets. 12mo.....$1.50

A Complete Guide for Coach Painters. Translated from the French of M. ARLOT, coach painter, for eleven years foreman to M. EHERLER Paris. By A. A. FESQUET, chemist and engineer. 12mo...$1.25

The Architect's and Builder's Pocket Companion and Price Book. By FRANK W. VOGDES, architect. Cloth.....$1.50
Pocket-Book form, full bound.....2.00

Hand-Book of Mineral Analysis. By FREDERICK WOHLER, University of Gottingen. Edited by H. B. NASON, Rensselaer Polytechnic Institute, Troy. 12mo.....$3.00

Table of Reactions for Qualitative Chemical Analysis. By H. B. NASON. Illustrated by colors.....68c.

Forsyth's Designs for Headstones, Mural and other Monuments. 78 designs. 4to.....$5.00

☞ The above, or any of my books, sent free of postage at the publication prices. My new and revised Catalogue of Practical and Scientific Books, 94 pages, 8vo, sent free of postage to any one who will furnish his address.

HENRY CAREY BAIRD,
INDUSTRIAL PUBLISHER,
406 WALNUT STREET, Philadelphia.

E. M. MAYO'S BOLT CUTTER, patented in 1867, improved in 1871, is the best in use. Send for Circular. Cincinnati, Ohio.

Washington Iron Works,

MANUFACTURERS of Steam Engines and Boilers, Saw Mills, Flouring Mills, Sugar Cane Mills, White's Patent Double Turbine Water Wheel, Gray's Patent Cotton and Hay Press, Baker's Anti-Friction Lining Metals, and American White Brass. Iron and Brass Castings, and general machinery. Send for Circular to Office, 60 Vesey st., New York.

EVERY USER OF STEAM POWER SHOULD HAVE

Bellis' Patent Governor.

It is the **CHEAPEST** and **BEST** regulator for Steam Engines known to mechanics.
We offer SPECIAL INDUCEMENTS to engine builders. ☞ Address for Circular and Price List,
SINKER, DAVIS & CO., Indianapolis, Ind.

SELF-OILERS. The only perfect article in the market. BEST and CHEAPEST. Made by HOLLAND & CODY, 8 Gold St., N. Y. Send for reduced price list.

EDSON'S
(FIRST PREMIUM)

RECORDING STEAM GAUGE.

Adopted by the U. S. Government, and the only gauge that affords **continuous records** of the pressure in addition to indicating the same, and ringing an alarm when the limit is reached.
The Recording Steam Gauge Co., of N. Y.,
91 Liberty street, New York.

For making boys intelligent, healthy, Christian MEN.
YONKERS MILITARY INSTITUTE.
Re-opens September 14th.
BENJAMIN MASON, Box 465, Yonkers, New York.

CIVIL & MECHANICAL ENGINEERING, at the Rensselaer Polytechnic Institute, Troy, N.Y. A higher and more practical Course of Instruction will be given here than has ever been attempted elsewhere in this country. Re-opens Sept. 13. For the Annual Register, containing improved Course of Study and full particulars, apply to PROF. CHARLES DROWNE, Director.

CIRCULAR SAW MILLS, PLANERS, POWDER KEG MACHINERY, etc., made by S. HEALD & SONS, Barre, Mass.

THE SOUTHWESTERN

EXPOSITION COMPANY

OF NEW ORLEANS, LA.,

HAVING SECURED THE LARGEST and most beautiful Building in the South, covering an entire square of ground in the business center of New Orleans, now offer to

MANUFACTURERS AND INVENTORS

Of all kinds of articles, whether for Farm, Plantation, Ship or House use, a

SURE, SAFE AND THOROUGH MEANS

Of introducing and selling their goods throughout the section of country of which New Orleans is the central distributing point.
Circulars and special information furnished, upon application, by mail, to the Secretary of the SOUTHWESTERN EXPOSITION COMPANY, New Orleans, La. P. O., Lock Box 538.

WOOD-WORKING MACHINERY GENERALLY. Specialties, Woodworth Planers and Richardson's Patent Improved Tenon Machines. Nos. 24 and 26 Central, corner Union st., Worcester, Mass.
WITHERBY RUGG, & RICHARDSON.

THE ONLY Machine that will mortise and bore house or car blinds successfully, in all kinds of stock, for fixed or rolling slats, making 50 mortises, or 140 round holes per minute, leaving the mortises free of chips. MARTIN BUCK, Agent, Lebanon, N.H.

$25 Steam Jet Pump. $25

The simplest and cheapest device ever known for raising water, oils, sirups, acids, etc. Capacity. 40 gallons per minute. Used in hotels, factories, mines, quarries, etc. Operated by steam direct from boiler. Has no valve or wearing parts of any kind. Is unaffected by sand or grit. Certain to work at all times. Sent to any address on receipt of $25.
SINKER, DAVIS & CO., Indianapolis, Ind.

THE PROPRIETORS OF A FIRST CLASS planing mill in Connecticut, now doing $150,000 business yearly, wish to add to their business the manufacture of some article of wood. Will buy no untried patent right. Address
E. L. B. New Haven, Conn.

WANTED!—A competent moulder, one capable of taking charge of a large Foundry, and who thoroughly understands making Car Wheels; also, a first class pattern-maker, as foreman of pattern-shop. The location is the most pleasant and healthy in the South. Address, NOBLE, BROTHERS & CO., Rome, Ga.

CLAVERACK COLLEGE and Hudson River Institute, at Claverack, N.Y. For both sexes. Term opens Sept. 4th. Rev. ALONZO FLACK, A.M., President.

GOLDEN HILL Seminary for Young Ladies Bridgeport, Conn. Miss Emily Nelson, Principal.

Compound Propeller Pump,

NOW ON EXHIBITION at Novelty Iron Works, 745 East Twelfth Street. All persons interested in Water Works, Mines, Quarries, Coffer Dams, Vessels, &c., are invited to call and examine this new and novel principle of elevating water. There will run daily, from 8 A.M. to 12 M., and from 1 P.M. to 6 P.M., two of these Pumps. One, twenty inches in diameter, drawing from ten to fourteen thousand gallons of water per minute. One, seven inches in diameter, driving one thousand gallons of water per minute, forty-three feet vertically. These elevators can raise or drive water to any required height, and in any required volume. Orders received for water works or pumps. Rights for sale. Enquire at Novelty Iron Works, of H. S. LANSING.

THE HYDRAULIC ROTARY GOVERNOR gives to turbine wheels, under any per cent of variation, speed equal to steam power. Warranty unlimited. Address J. S. ROGERS, TR., 19 John st., Boston, Mass.

Reynolds'

TURBINE WATER WHEELS.

The Oldest and Newest. All others only imitations of each other in their strife after complications to confuse the public. We do not boast but quietly excel them all in staunch reliable, economical power. Beautiful pamphlet free. GEO TALLCOT
96 Liberty st., New York.
Gearing, Shafting.

STEEL CASTINGS

TO PATTERN; tensile strength equal to wrought iron; will rivet over, bend, or case harden. Heavy work at low prices. PHILIP S. JUSTICE,
14 North 5th st., Phila.; 42 Cliff st., New York.

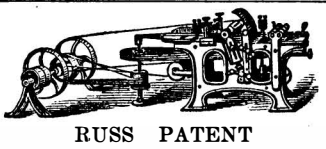
A. S. & J. GEAR & CO., 56, 58, 60 and 62 Sudbury st., Boston, Mass., have the largest Machinery Depot in the United States, where they show machinery running.

FOOT LATHES,

And all kinds of small Tools. Illustrated catalogue free GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass.

$10 from 50 cts.

12 SAMPLES sent (postage paid) for Fifty Cents, that retail easily for Ten Dollars.
R. L. WOLCOTT, No. 181 Chatham Square, N.Y.



RUSS PATENT

MONITOR MOLDING MACHINE,

MADE BY

R. BALL & CO., Worcester, Mass.

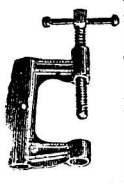
Manufacturers of the latest Improved WOOD-WORKING MACHINERY for Planing Mills, Car Shops, Agricultural Implements, Furniture, Sash, Blind, and Door Factories etc., etc. Send for Illustrated Catalogue and Price List.
RICHARD BALL. E. P. HALSTED.

THE PERFECT LUBRICATOR

24 CLIFF NEW-YORK

A sure preventive of and cure for hot journals. Has ten times the lubricating quality of any oil. 4000° F., 50° below zero, acids or gases do not affect or change its wonderful, unique nature. Forms on bearing surfaces a glaze of unequaled smoothness, which economizes power 20 per ct.; reduces friction to a minimum, and prevents heat, wear, strain, and repairs of machinery. Send for envelope sample and circular to

AMERICAN GRAPHITE CO.



LeCOUNT'S PATENT

Lathe Dogs & Clamps,

Of both Iron and Steel.
LeCount's Patent
EXPANDING MANDREL,
For use in the Lathe.
Send for latest Circular.
C. W. LeCOUNT,
South Norwalk, Conn.

BENT, GOODNOW & CO., Boston, Mass., Publishers of "PATENT STAR," sell Patent Rights and goods of all kinds. Orders solicited. AGENTS WANTED.
☞ Send stamp for copy.

Portable & Stationary Steam Engines

AND HOISTING ENGINES. A good article at low prices. Every machine warranted Send for descriptive Price List.
H. B. BIGELOW & CO.,
New Haven, Conn.

PURCHASE Machinery of every description of A. S. & J. GEAR & Co., 56, 58, 60 and 62 Sudbury st., Boston, Mass., where Machinery can be seen running.

THE CELEBRATED

Cold-rolled Shafting.

THIS Shafting is in every particular superior to any turned Shafting ever made. It is the most ECONOMICAL SHAFTING to buy, being so very much stronger than turned Shafting. Less diameter answers every purpose causing a great saving in coupling, pulleys and hangers. It is perfectly round, and made to Whitworth Gage. All who give it a trial continue to use it exclusively. We have it in large quantities. Call and examine it, or send for price list.
Address GEORGE PLACE & CO.,
126 and 128 Chambers st., New York.

Sturtevant Blowers.

THESE are in every particular the best and most perfect Blower ever made. A full assortment of every size on hand, ready to deliver.
Address GEORGE PLACE & CO.,
126 and 128 Chambers st., New York.

N. Y. Machinery Depot.

GEORGE PLACE & CO., Manufacturers and Dealers in Wood and Iron Working Machinery, of every description, Stationary and Portable Engines and Boilers, Leather and Rubber Belting, and all articles needful in Machine or Railroad Repair Shops. 126 and 128 Chambers st., New York.

MODELS, PATTERNS, EXPERIMENTAL, and other machinery, Models for the Patent Office. built to order by HOLSKE MACHINE CO., Nos. 528, 530, and 532 Water st., near Jefferson. Refer to SCIENTIFIC AMERICAN office. 14 tf

Andrew's Patents.

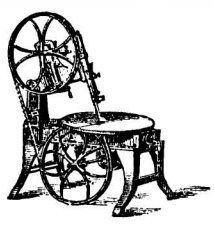
Noiseless, Friction Grooved, Portable, and Warehouse Hoisters.
Friction or Geared Mining & Quarry Hoisters.
Smoke-Burning Safety Boilers.
Oscillating Engines, Double and Single, 1-2 100-Horse power.
Centrifugal Pumps, 100 to 100,000 Gallons per Minute, Best Pumps in the World, pass Mud, Sand, Gravel, Coal, Grain, etc., without injury.
All Light, Simple, Durable, and Economical. Send for Circulars.
WM. D. ANDREWS & BRO.,
414 Water street, New York.

1832. SCHENCK'S PATENT. 1871

WOODWORTH PLANERS

And Re-Sawing Machines, Wood and Iron Working Machinery, Engines, Boilers, etc. JOHN B. SCHENCK'S SONS, Matteawan, N. Y., and 118 Liberty st., New York.

PATENT BANDSAW MACHINES



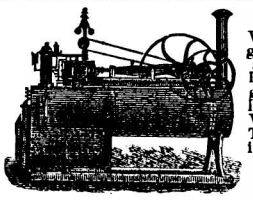
Of the most approved kinds, of various sizes, to saw bevel as well as square, without inclining the table, by **FIRST & PRYIBIL,** 452 to 456 Tenth ave., New York. Price $250, $275, $350, and $400. At present (Oct. 16), there are in operation, in this city alone, 88 of our machines. Send for circular. Manufacture, also, an improved saw-filing apparatus; price, $30. Have also on hand a large stock of best FRENCH BANDSAW BLADES.

NORWALK IRON WORKS,

SOLE PROPRIETORS and Makers of the Norwalk Engine and Earle Steam Pump, Stationary and Portable Engines, Direct Acting and Balance Wheel Steam Pumps, Air and Vacuum Pumps.
Salesroom, 133 Center street, New York.

P. BLAISDELL & Co.,

MANUFACTURERS OF FIRST CLASS **MACHINISTS' TOOLS.** Send for Circulars.
Jackson st., Worcester, Mass.



THE AMES IRON WORKS.—Portable Engines, 3 to 40 H.P.; Circular Saw Mills, Vertical and Horizontal Stationary Engines and Boilers, Hoisting Engines, Burr Mills, Wood and Iron Working Tools. Send for valuable information to
EDW'D P. HAMPSON,
38 Cortlandt st.,
New York.

MACHINISTS.

Illustrated Catalogue and Price List of all kinds of small Tools and Materials sent free to any address. GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass.

HAND SAW MILL.—Do work of 3 men. Rip 3-inch lumber with ease. Thousands in use. Agents wanted everywhere. WM. H. HOAG,
32 Cortlandt st., New York.

DAVIS' PATENT

RECORDING PRESSURE GAUGES.

THE ONLY instruments that record the TIME of variations in pressure. Send for Circulars to
D. P. DAVIS, 44 Cortlandt st., New York.

Niagara Steam Pump

CHAS. B. HARDICK,
Adams st., Brooklyn, N. Y.

HOW, WHEN, and WHERE TO ADVERTISE.

SEE THE ADVERTISER'S GAZETTE,

BOOK OF ONE HUNDRED PAGES,

Issued Quarterly (new edition JUST OUT), contains Lists of ALL THE BEST NEWSPAPERS, Daily, Weekly, Religious, Agricultural, Local, and Political; also, MAGAZINES, and all Periodicals devoted to class interests; also, estimates showing

COST OF ADVERTISING,

and hints, incidents, and instructions gathered from the

Experience of Successful Advertisers.

Mailed to any address **FOR 25 CENTS.**
Address

GEO. P. ROWELL & CO.,
Advertising Agents, Publishers, and Dealers in All Kinds of Printers' Materials.
NO. 41 PARK ROW, NEW YORK.

RICHARDSON, MERIAM & CO., Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines, Matching, Sash, and molding, Tenoning, Mortising, Boring, Shaping, Vertical, and Circular Re-sawing Machines, Saw Mills Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty st. New York. 17 1

TURBINE WATER WHEEL and Double-Acting Force-Pump Rights for sale. JEREMIAH BARNEY, Perry's Mills, N, Y.

OTIS' SAFETY HOISTING Machinery.

OTIS, BROS. & CO.
No. **348** BROADWAY, NEW YORK.

PUMPS.—For Description, Price Lists etc., of the Best Centrifugal Pump ever invented, with Overwhelming Testimony in its favor, send for new illustrated pamphlet (40 pp.) to Messrs. HEALD, SISCO & CO. Baldwinsville, N. Y.

WROUGHT IRON BEAMS & GIRDERS

THE Union Iron Mills, Pittsburgh, Pa. The attention of Engineers and Architects is called to our improved Wrought-iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided, we are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph address Carnegie, Kloman & Co., Union Iron Mills, Pittsburgh, Pa

MACHINISTS' TOOLS, at greatly reduced prices. Also, some Woodworth Planers and Second-hand Tools. 97 to 113 R.R. ave., Newark, N.J.
E. & R. J. GOULD, successors to Gould Machine Co

CINCINNATI BRASS WORKS.—Engineers and Steam Fitters' Brass Work, Best Quality at very Low Prices. F. LUNKENHEIMER, Prop'r.

BURDON IRON WORKS.—Manufacturers of Pumping Engines for Water Works, High & Low Pressure Engines, Portable Engines and Boilers, of all kinds, Sugar Mills, Screw, Lever, Drop, & Hydraulic Presses, Machinery in general. HUBBARD & WHITTAKER, 10 Front st., Brooklyn.

MACHINERY NEW and 2d-HAND.... Send for Circular. CHAS. PLACE & CO., 60 Vesey st., New York.

Agents! Read This!

WE WILL PAY AGENTS A SALARY OF **$30 per week** and expenses, or allow a large commission, to sell our new and wonderful inventions.
Address M. WAGNER & CO., Marshall, Mich.

WOODBURY'S PATENT

Planing and Matching

and Molding Machines, Gray & Wood's Planers, Self-oiling Saw Arbors, and other wood working machinery.
S. A. WOODS, { 91 Liberty street, N. Y.;
Send for Circulars. { 67 Sudbury street, Boston

Tanite Emery Wheels

AND GRINDING MACHINES.
S. A. WOODS, General Agent.
Machinery Depot, 91 Liberty st., New York.

$250 A MONTH easily made with Stencil and Key-Check Dies. Secure Circular and Samples FREE. S. M. SPENCER, Brattleboro, Vt.

THOMSON'S PATENT

ROAD STEAMER.

THE only locomotive that will haul heavily loaded trains on ordinary American roads. Saves 50 per cent over horses, and does not injure the roads. Also adapted for **plowing by direct traction.**
Can be seen in operation near New York. Open for competition with any other Road Engine.
For full particulars, address the Sole Manufacturer in America, D. D. WILLIAMSON,
P.O. Box 1809, or 32 Broadway, New York city.

BUERK'S WATCHMAN'S TIME DETECTOR.—Important for all large Corporations and Manufacturing concerns—capable of controlling with the utmost accuracy the motion of a watchman or patrolman, as the same reaches different stations of his beat. Send for a Circular. J. E. BUERK,
P. O. Box 1,057 Boston, Mass.
N. B.—This detector is covered by two U. S. Patents. Parties using or selling these instruments without authority from me will be dealt with according to law.

WANTED—AGENTS, $20 PER DAY, TO sell the celebrated HOME SHUTTLE SEWING MACHINE. Has the under-feed, makes the "lock stitch" alike on both sides, and is fully licensed. The best and cheapest Family Sewing Machine in the market. Address
JOHNSON, CLARK & CO.,
Boston, Mass.; Pittsburgh, Pa.; Chicago, Ill. or St. Louis, Mo.

$150 A MONTH! EMPLOYMENT EXTRA INDUCEMENTS!
A premium HORSE and WAGON for Agents. We desire to employ agents for a term of seven years, to sell the Buckeye $20.00 Shuttle Sewing Machine. It makes a stitch alike on both sides, and is the best low-priced licensed machine in the world. W. A. HENDERSON & CO., Cleveland, Ohio, or St. Louis, Mo.

L. & J. W. FEUCHTWANGER, 55 Cedar st., New York, Chemists, Importing and Manufacturing. Silicates of Soda and Potash, Soluble Glass in all forms, Steel and Glass Makers', Potters' and Enamelers' Materials, Pure Metallic Oxides and Metals, Hydrofluoric Acid. All articles of the best quality, and orders promptly attended to. Publishers of Treatises on "Soluble Glass," "Gems," and "Fermented Liquors."

SCIENTIFIC AMERICAN

TWENTY-SIXTH YEAR.

A New Volume Commences July 1st.

EVERY NUMBER is printed on fine paper and elegantly illustrated with original engravings representing

New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Photography, Architecture, Agriculture, Engineering, Science, and Art.

Farmers, Mechanics, Inventors, Engineers, Chemists Manufacturers, and People of all Professions or Trades will find the

SCIENTIFIC AMERICAN

of great value and interest.

The Editors are assisted by many of the ablest American and European Writers, and having access to all the leading Scientific and Mechanical Journals of the world, the columns of the SCIENTIFIC AMERICAN are constantly enriched with the choicest Information.

An Official List of all the Patents Issued is published Weekly.

The Yearly Numbers of the SCIENTIFIC AMERICAN make two splendid Volumes of nearly ONE THOUSAND PAGES equivalent in size to FOUR THOUSAND ordinary book pages.

SPECIMEN COPIES SENT FREE.

TERMS—$3·00 a year, $1·50 half year; Clubs of Ten Copies for one year, at $2·50 each, $25·00, With a SPLENDID PREMIUM to the person who forms the Club, consisting of a copy of the celebrated Steel Plate Engraving, "Men of Progress."

Address

MUNN & CO.,
PUBLISHERS OF THE SCIENTIFIC AMERICAN
37 Park Row, New York.

© 1871 SCIENTIFIC AMERICAN, INC.

Advertisements.

Advertisements will be admitted on this page at the rate of **$1·00** *per line for each insertion. Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.*

VULCANIZED RUBBER

Adapted to Mechanical Purposes. New York Belting and Packing Co., 37 & 38 Park Row.

FOR SALE.

Extensive Machine Works.

ONE OF THE LARGEST AND BEST ESTABLISHED IN THE WEST, having been in operation for twenty-six years.

The partnership in the old and well known FIRM OF OWENS, LANE, DYER & CO. being about to expire by limitation, and some of the members wishing to retire from active attention to the business, an undivided ONE-HALF INTEREST is now offered for sale in their extensive works, known as "THE ECLIPSE MACHINE WORKS," located at HAMILTON, OHIO, twenty-five miles from Cincinnati, on the line of the Cincinnati, Hamilton & Dayton and Atlantic & Great Western Railroads—having close connections with all leading railroads to the North, East, South and West—consisting of large, capacious, and well appointed work shops, with AMPLE WATER POWER, secured at low rate by perpetual lease, with all the TOOLS, MANUFACTURING MACHINERY, PATTERNS, and PATENT RIGHTS, including entire control of the patents upon the celebrated ECLIPSE CIRCULAR SAW-MILL, with many other patents owned and used exclusively by them in the construction of their machinery, together with the name, reputation and good will of the firm,

FOR THE SUM OF $62,500.

The remaining ONE HALF to be retained by the PRESENT OWNERS. The whole to be incorporated into a JOINT STOCK COMPANY, under the laws of the State of Ohio, for the purpose of manufacturing PORTABLE AND STATIONARY ENGINES, CIRCULAR SAW MILLS, STEAM THRASHERS, and other Machinery.

The shops are well furnished with complete outfit of Manufacturing Machinery and Tools of the latest and most improved kinds, much of it specially designed, and probably the most effective for the work required to be found in any establishment in the country, East or West.

The facilities for shipment of STOCK to the Works, or of FINISHING MACHINERY to any point, cannot be surpassed.

A switch and heavy crane give every convenience for loading directly from the shops upon cars upon all the leading thoroughfares in the country.

The establishment has been in successful operation without stoppage, suspension or interruption for twenty-five years, and for the past decade has had from 200 to 300 employes.

This is a rare chance for a few good, active, practical men to engage in one of the safest and best established manufactories in the West, in full operation, and at a remarkably low figure.

All inquiries, accompanied with satisfactory reference, will be promptly answered, and any information given by addressing or calling upon us at the Works.

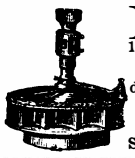
In case of parties preferring to propose for the purchase of a LARGER or THE WHOLE INTEREST, offers to that effect will be considered.

OWENS, LANE, DYER & CO.

Hamilton, O., July 26.

TODD & RAFFERTY, Manufacturers of Steam Engines, Boilers, Flax, Hemp, Tow Bagging Rope and Oakum Machinery. Steam Pumps and Governors always on hand. Also Agents for the New Haven Manufacturing Co.'s Machinists' Tools. ☞ We invite especial attention to our new, improved, Portable Steam Engines. Warerooms, 10 Barclay st.; Works, Paterson, N. J.

Leffel's Improved Turbine.



NEARLY SIX THOUSAND of them in use; under heads from 1½ to 240 feet.

☞ Send for our pamphlet, one hundred and twenty pages.

JAMES LEFFEL & CO.,
Springfield, Ohio, and New Haven, Conn

PATENT

Cold Rolled Screws.

OWING to the fine finish and peculiar stiffness of Cold Rolled Iron, it is eminently suited for screws of all kinds. We are largely engaged in supplying LATHE CUT SCREWS of all dimensions. To parties in want of finished screws, for Cotton, Cider, or Letter Presses, Lathes, or other machinery, we think that we can make satisfactory prices on receipt of specifications. **JONES & LAUGHLINS,**
120 Water St., Pittsburgh, Pa.

DIAMOND TURNING TOOLS,

FOR Solid Emery Wheels, $15 each. Address "The Tanite Company," Stroudsburg, Pa.

TO MANUFACTURERS—The patentee of a valuable invention wants to sell the entire patent for the States. To a practical man or company a rare chance is offered. Address,
J. R. C., Baltimore, Md.

CHAPIN'S Patent Transparent Waterproof Varnish prevents the action of rust on polished surfaces, and will not dim the lustre of the metal to which it is applied. Is now used by many of the largest Machine and Engine builders. Paper and Cloth become waterproof, after receiving one or two applications. Will be furnished by the gallon or barrel. Address
C. V. CHAPIN & CO., Collinsville, Conn.

WATER POWER to Lease for a term of years, at Cooperstown, N.Y. Never failing water power—rail communication with New York via Albany—other railroads under construction—a large building on the premises, with power connected, which could easily be arranged for any manufacturing purpose. Apply to JOHNSTON BROS., Cooperstown, N.Y.

GEO. W. READ & CO.,
MANUFACTURERS AND IMPORTERS,

VENEERS,

FANCY WOODS & BOARDS,

Have in store the finest assortment ever seen, particularly,
FRENCH VENEERS, HUNGARIAN ASH, ETC.,
to which they invite the particular attention of the trade.
Send for catalogue and price list.
For SALE, one of the best and largest VENEER CUTTING MACHINES in the country.
170 and 172 Centre st., New York.
Factory, 186 to 200 Lewis st.

STEAM ENGINES & BOILERS

From 4 to 500 horse power, including Corliss Engines, Slide Valve Stationary Engines, Portable Engines, etc. Also, Circular Saw Mills, Shafting, Pulleys, etc. Wheat and Corn Mills, Circular Saws, etc.

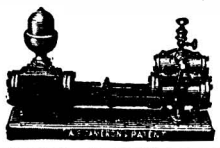
Send or Price List.

WOOD & MANN
Steam Engine Company
WORKS—UTICA, N.Y.

PRINCIPAL OFFICE—**42 Cortlandt st., New York.**

PAT. SOLID EMERY WHEELS AND OIL STONES, for Brass and Iron Work, Saw Mills, and Edge Tools. Northampton Emery Wheel Co. Leeds, Mass.

A. S. CAMERON & CO.,
ENGINEERS,



Works, foot of East 23d street, New York city.

Steam Pumps,

Adapted to every possible duty.
Send for a Price List.

Pratt's Astral Oil.

First Premium and Diploma at American Institute Fair, 1869 and 1870, for **SAFEST and BEST** ILLUMINATING OIL. Oil House of **CHAS. PRATT, N. Y.**
Established 1770.

SAFES. MARVIN & CO.'S ARE THE BEST.

265 BROADWAY.

CEMENTS.

ENGLISH, Portland, and Roman Cement, for sale by LAWRENCE & EDMANDS, 214 Pearl st., N.Y.

JAMES W. QUEEN & CO.,
924 Chestnut st., Philadelphia;
535 Broadway, New York.

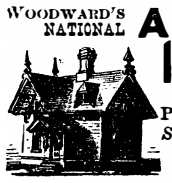
Opticians, Mathematical and Philosophical Instrument Makers, and Importers.

Spectacles, Microscopes, Opera Glasses, Drawing Instruments, Transits, Levels, Tape Measures, Thermometers, Barometers, Magic Lanterns, etc., etc.

Manuals, as follows, sent for 10 cents each:

Part	1st, Mathematical Instruments	155 pages.
"	2d, Optical Instruments	100 "
"	3d, Magic Lanterns and Stereopticons	88 "
	4th, Philosophical Instruments	66 "

WOODWARD'S NATIONAL

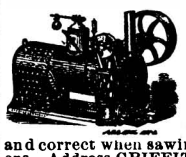


ARCHITECT.

1000 Working Drawings, $12, post-paid.

GEO. E. WOODWARD,
Publisher, 191 Broadway, N. Y.
Send for Catalogue of all books on Architecture, Agriculture, Field Sports and the Horse.

Patent Vertical Portable Engine.



Our guarantee is—more steam, less fuel, stronger in running, safer to run, less friction, and more durable, than any Old Style Portable, with Engine on Boiler, of same dimensions. Our Saw Mills are strong and well made—Lever Head Blocks, with Patent Roller set; quick setting, and correct when sawing. Stationary Engines and Boilers. Address GRIFFITH & WEDGE, Zanesville, Ohio.

L. L. SMITH & CO.,
Nickel Platers,

6 HOWARD ST., New York,
Between Elm and Centre.

BUILDING PAPER

OF THREE GRADES.

TARRED SHEATHING,

For outside of Studding, under Clapboards. A non-conductor of cold, heat, and dampness.

PREPARED PLASTERING BOARD,

a cheap and perfect substitute for lath and plaster; makes a smooth, warm, and substantial wall, at less than half the usual cost.

DOUBLE THICK ROOFING

and Quartz Cement, make a good water and fire-proof roof, for less than $3.50 per square.

Sample and Circulars sent free, by
ROCK RIVER PAPER CO.,
Chicago; or
B. E. HALE,
22 & 24 Frankfort street, N. Y.

Pennock's Patent
Iron Bending Machine,

INVALUABLE in Car and Machine Shops. Saves several times its cost in one year's use. Instantly adjustable to thickness, and bends at any desired angle. Price, $150. Address
THE PENNOCK MANUFACTURING CO.,
Kennett Square, Chester Co., Pa.

OFFICE OF THE BOARD FOR THE EXAMINATION OF AND LICENSING DRUGGISTS AND PRESCRIPTION CLERKS in the City of New York, 72 Union Place.

ALL DRUGGISTS AND PRESCRIPTION Clerks in the City of New York are hereby respectfully notified that the Board duly appointed in accordance with chapter 202 of the laws of 1871 of this State, will meet for the purpose of conducting examinations, Daily, between the hours of 10 A. M. and 3 P. M., at their office, No. 72 Union Place.

Druggists will be examined first, and notified in alphabetical order. Due notice will be afterwards given to prescription clerks.

The subjects for examination will be chemistry, poisons and their antidotes, practical pharmacy and officinal botany, materia medica, prescriptions, and the adulterations of drugs. The office will be open daily 10 A. M. to 3 P. M.

R. OGDEN DOREMUS, M. D.,
President.
WILLIAM GRAHAM,
THEOBALD FROHWEIN,
C. M. O'LEARY, M. D.,
Commissioners.

LOUIS G. BRANDA, *Secretary.*
New York, July 20, 1871.

WIRE ROPE.

JOHN A. ROEBLING'S SONS,
MANUFACTURERS, TRENTON, N. J.

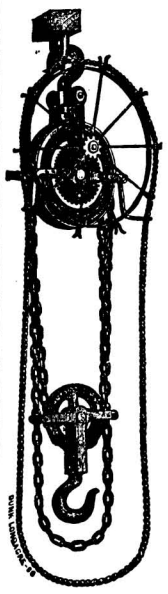
FOR Inclined Planes, Standing Ship Rigging, Bridges, Ferries, Stays, or Guys on Derricks & Cranes, Tiller Ropes, Sash Cords of Copper and Iron, Lightning Conductors of Copper. Special attention given to hoisting rope of all kinds for Mines and Elevators. Apply for circular, giving price and other information. Send for pamphlet on Transmission of Power by Wire Ropes. A large stock constantly on hand at New York Warehouse, No. 117 Liberty street.

TRADE MARK.

Union Stone Co.,

Patentees and Manufacturers of
ARTIFICIAL STONE & EMERY WHEELS,
and Artificial Stone and Emery Wheel Machinery and Tools. Send for circular. **32 Pemberton Square, BOSTON, MASS.**

Harrison Safety Boiler.

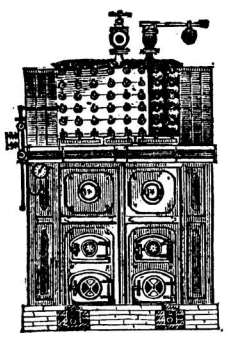


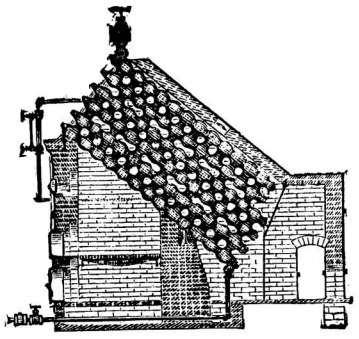
Has been in practical use for more than ten years.

25,000 HORSE POWER IN USE.

INTERNATIONAL MEDAL, LONDON, 1862.
AMERICAN INSTITUTE MEDAL, 1869.
SEND FOR CIRCULARS TO

HARRISON BOILER WORKS, Philadelphia, Pa., or
J. A. Coleman, Agent, 110 Broadway, N.Y., or 139 Federal st., Boston, Mass.





WESTON'S PATENT DIFFERENTIAL

PULLEY BLOCKS,

75,000 IN USE.

Address
Harrison Boiler Works,
PHILADELPHIA,
Or, JOHN A. COLEMAN, Agent,
110 BROADWAY, New York, or 139 FEDERAL ST., Boston, Mass.

☞ T. V. Carpenter, Advertising Agent. Address hereafter, Box 778, New York city.

Swain Turbine.

"Our Low-Water Wheel from this on"

WILL DO TEN PER CENT MORE WORK on small streams, in a dry season, than any wheel ever invented. Gave the best results, in every respect, at the Lowell Tests.

For Report of tests at Lowell, with Diagrams and Tables of Power, address

THE SWAIN TURBINE CO.,
North Chelmsford, Mass.

L. W. Pond---New Tools.

EXTRA HEAVY AND IMPROVED PATTERNS

LATHES, PLANERS, DRILLS, of all sizes Vertical Boring Mills, ten feet swing, and under Milling Machines, Gear and Bolt Cutters; Hand Punches and Shears for Iron.

Office and Warerooms, 98 Liberty st., New York; Works at Worcester, Mass.

A. C. STEBBINS New York Agent.

American Saw Co., Manufacturers of

And Perforated Circular and Long Saws. Also Solid Saws of all kinds. No. 1 Ferry st., cor. Gold street, New York. Branch Office for Pacific Coast, No. 606 Front street, San Francisco, Cal.

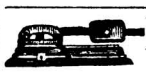
Chemical Analyses and Investigations

J. H. TIEMANN & CO.,
165 Chambers street.

BUILDERS and all who contemplate building, supplied with free descriptive circular of "Village Builder." Address A. J. BICKNELL & CO., Publishers, 27 Warren st., New York.

THE
Tanite Emery Wheel.

Does not Glaze, Gum, Heat, or Smell. Address
THE TANITE CO.
Stroudsburg, Monroe Co., Pa.



BEST DAMPER REGULATOR for Steam Boiler. Send for Circulars.
MURRILL & KEIZER, Balt., Md.

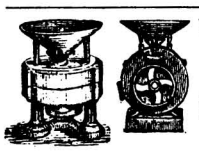
Working Models

And Experimental Machinery, Metal, or Wood, made to order, by J. F. WERNER 62 Center st. N.Y

UNION

Spoke Works.

SPOKES, RIMS, AND PLOW HANDLES. All goods warranted seasoned, and of the best quality. JOHN G. DAVIS & SON,
Southwest cor. of Leonard and Otter sts., Philadelphia.



Vertical & Horizontal CORN MILLS.

30-inch grinds 90 bus. per hour, and 20-in. 15. Price $220 and $140.
EDWARD HARRISON,
New Haven, Conn.

BEST PORTLAND CEMENT, for manufacturing artificial stone.
L. JAFFE, 1193 Broadway.

IRON STEAMSHIP BUILDERS.

NEAFIE & LEVY,

PENN WORKS,

MARINE ENGINES, BOILERS, ETC.,
PHILADELPHIA, PA.

THE NEW YORK
(VIADUCT)
RAILWAY COMPANY.

PUBLIC NOTICE.

The undersigned COMMISSIONERS of STOCK SUBSCRIPTIONS to the NEW YORK RAILWAY COMPANY, give notice that the **Books of Subscription** to the Capital Stock of such Company **WILL BE CLOSED** on the

31st day of August, 1871.

UNTIL THAT DAY the Books will remain open for Subscribers at the Banking House of

DUNCAN, SHERMAN & CO.,
No. 11 Nassau street.

and also at the

BANK OF THE METROPOLIS,
No. 31 Union Square.

Until the Books of Subscription are closed, ALL SUBSCRIBERS for Stock will have the **Benefit of Interest** upon the several instalments paid, and as allowed to those subscribing within thirty days after the Books were opened.

Dated, NEW YORK, July 24, 1871.

Alex'r T. Stewart,
John Jacob Astor,
Levi P. Morton,
} Commissioners on behalf of the Company.

THE
Allen Engine Works.

THE ALLEN ENGINE.

Fourth avenue and 130th and 131st sts. New York city
Manufacturers of
Porter's Governor,
The Allen Boiler, and
Standard Straight Edges, Surface Plates, and Angle Plates.

Four first premiums were awarded to us at the Fair of the American Institute, 1870.
Send for our illustrated circular.

SCHLENKER'S PATENT
BOLT CUTTER
NEW INVENTION. ADDRESS,
HOWARD IRON WORKS, BUFFALO, N.Y.

IRON PLANERS, ENGINE LATHES, Drills, and other Machinists' Tools, of superior quality, on hand, and finishing. For sale low. For Description and Price address NEW HAVEN MANUFACTURING CO., New Haven, Conn.

FOR THE CHEAPEST WATER GAUGES, send to HOLLAND & CODY, 8 Gold St., N. Y.

TARRANT'S SELTZER APERIENT.

CURES
Costiveness,
RELIEVES
Headache,
AIDS
Digestion.
Sold by all Druggists.

DRAWING INSTRUMENTS, Tracing Paper, Cloth, etc. Send two 3-cent stamps for Catalogue. Address A. J. BICKNELL & CO., 27 Warren st., N.Y

A. S. & J. GEAR & CO., Boston, furnish every description of Wood and Iron Working Machinery and Supplies. The best in use, regardless of maker at lowest possible rates.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard sts. Philadelphia, and 59 Gold st., New York.

© 1871 SCIENTIFIC AMERICAN, INC.